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and
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The Outlook

Fighters in Norway

THE British troops in Norway must have hailed with great delight the arrival of some fighter aircraft. Before they came the bombers of the *Luftwaffe* had had it all their own way, and to be bombed without a chance of hitting back is a heavy test of steadiness in soldiers. It is also no light test of adaptability for the fighters to establish themselves on a frozen lake as an aerodrome, where they too had to undergo a dose of bombing, and had some machines damaged. Evidently they did not take long to make their presence felt, and, as a result of their doings and the efforts of the anti-aircraft guns which have also been landed, fourteen German aircraft have been shot down or damaged. Since then all the reports speak of a much greater degree of circumspectness on the part of the German bombers.

This anti-bomber defence was one of the first great needs of the Expeditionary Force, but another urgent need must be reconnaissance aircraft. An army always needs information, but it has especial need for it in mountain warfare. Capt. Macmillan comments on this aspect of the campaign in the article which we publish on another page. We think that he is rather severe in blaming the Air Ministry for not having foreseen and provided for a campaign in Norway, because seven months ago nobody but a clairvoyant could have been expected to foresee it. Without foreseeing such a situation, there would not have seemed much reason for providing numbers of floatplanes for army co-operation work, and yet now the N.W.B.E.F. must be longing for floatplanes which could work from the fjords and tell the staff what is on the other side of any number of hills. The fighters will doubtless do what they can to help, though fighter pilots have not been trained for that sort of work, and perhaps the versatile Coastal Command, whose observers are trained to use their eyes, though ships rather than troops are what they are expected to spot, will give a hand. It should not be impossible to send trained army co-operation pilots as observers in Coastal Command aircraft. We have no doubt that the Air Staff men are using their active wits to devise means for giving the N.W.B.E.F. all the air help which it has so badly needed.

No Atlantic Service

THE last faint hopes for a North Atlantic service this summer, which might have been lingering in some people's minds, were finally dispelled by Captain Balfour's announcement that *Caribou* and *Cabot* are to be retained on their military work. These boats are the only two suitable for the transatlantic route, as the three "G" class boats, though they have flown, are not quite ready. So Britain will not be seen on the broadest of the ocean highways this year.

It is not a general deficiency of aircraft which causes these two boats to be taken off the work for which they were designed and built, for our factories are turning out thousands. But military design for Coastal Command work has lagged far behind, and so has caused the production of aircraft specifically intended for Coastal Command duties to lag also. Nearly all the craft engaged on these duties today are converted civil types. The Lockheed Hudson was first an airline machine, operating in numbers. The Avro Anson was also a civil design taken and adapted for military purposes. The Sunderland was specially designed, but owes much to the Empire boat.

The situation is not one for congratulation, but we must do the best with it and be reconciled to the loss of economic advantages, operating experience and

prestige which our absence this year from the Atlantic will cost us. The converted civil aircraft, and particularly the requisitioned ones, are performing well on the Coastal Command work, but the urgency of providing real military types for this important duty cannot be over-emphasised, as it is essential that *Caribou* and *Cabot* be released to proceed upon their lawful occasions.

Equality in Decorations

AN interdepartmental committee, representing the three fighting Services, is now sitting to consider the question of making decorations for gallantry similar in the case of officers and "other ranks" who have won them. In the case of the Distinguished Flying Cross and the Distinguished Flying Medal, two men may have volunteered for the R.A.F. at the same time. They may have passed together through the I.T.W., the Elementary School, and the Flying Training School as airmen, and may well have become intimate friends during their course of training. At the end, one receives a commission while the other becomes a sergeant pilot. Later on they may both have been engaged in the same air combat and have behaved with equal gallantry and been awarded decorations. It seems incongruous that one should receive the Cross and the other the Medal. One carefully refrains from writing "only the Medal," for the honour conferred by both is equal.

It may be useful to examine the whole question. In the first place, all war medals are the same for all ranks. Among decorations the Victoria Cross and the Empire Medal for Gallantry are also the same for all ranks. These are common to all Services. Next in honour to the V.C. comes the Distinguished Service Order, open to officers of all three Services. The equivalent for other ranks in the Army is the Medal for Distinguished Conduct in the Field (D.C.M.) and for naval ratings the Distinguished Service Medal (D.S.M.). There is no equivalent to these last two open to R.A.F. airmen. It may be thought appropriate to confine the D.S.O. to officers, as it is an Order, and Orders have old traditions. Moreover, the records of the D.C.M. and D.S.M. are so glorious that any interference with them might well be resented.

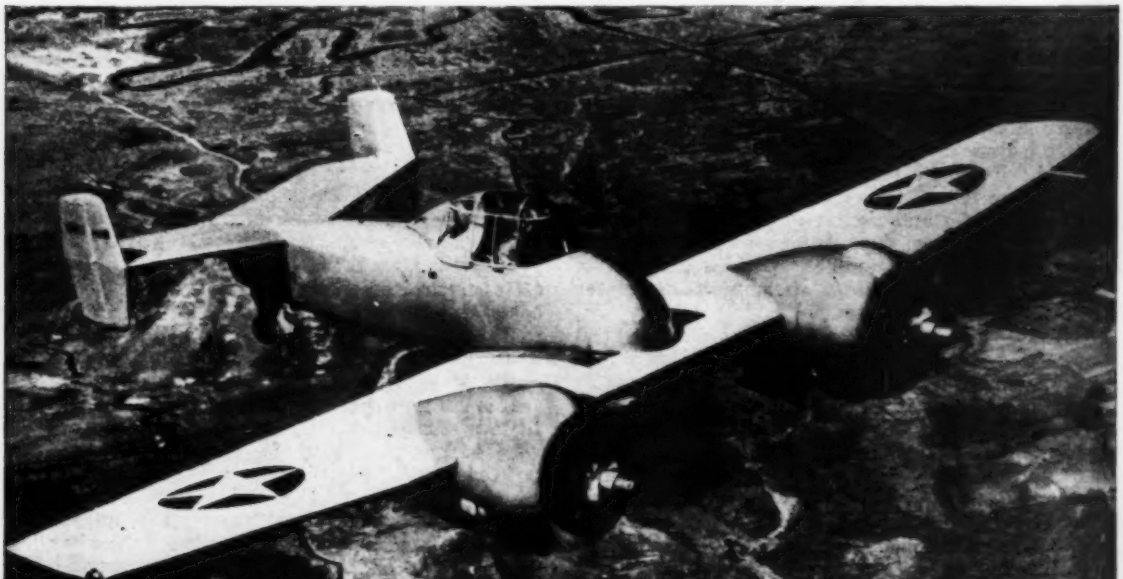
The real crux of the matter is the intermediate category of gallantry for which each Service gives its own pair of decorations, namely, the Distinguished Service Cross and Medal (D.S.C. and D.S.M.) for the Navy, the Military Cross and Medal (M.C. and M.M.) for the Army, and the D.F.C. and D.F.M. for the Air Force. To combine each of these pairs into one decoration open to all ranks would probably be popular with officers and other ranks alike.

Telling the World

A QUESTION asked in the House of Commons last week gave the Under-Secretary of State for Air, Captain Harold Balfour, an opportunity to emphasise the Government's policy in letting British aviation journals go abroad. In so doing, Capt. Balfour paid the British aviation press a compliment of which we are proud: "They (British aviation journals) are of high repute and provide a means of making known to the world the excellence of our products."

To the question of whether any German publication provided for us the same information, Capt. Balfour replied: "German publications, even in peacetime, have never furnished information comparable with that contained in British aviation journals."

We quote this partly because we are not unmindful of the honour which the Under-Secretary of State for Air has thus bestowed upon the British aviation press, but also to let those of our readers who do not see foreign aviation journals know that they are well served by their own.



A TWIN-ENGINED DECK-LANDING FIGHTER: The new Grumman single-seater twin-engined fighter built for the U.S. Navy as a deck-landing machine. It is popularly known as the Skyrocket. The engines are Wright Cyclones, and it is believed that the armament comprises two shell-guns and four machine-guns.

Westland Lysander army co-operation machines which are superior to their German counterparts the Henschel Hs 126s.

AIR STRATEGY

THE SOLDIER MIND in the AIR

Difficulties of Army Co-operation Work in Norway

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

NO innuendo is implied in the title I have chosen. I do not mean that the military mind is wandering but that the British air effort is being controlled in accordance with established military staff principles. And some of those principles have been the origin of jokes that are hoary with age, such as the one about the Colonel telling the Major, and the Major passing the order on to the Captain, who gives it to the Lieutenant, until at long last the Drummer-boy has to carry out the order. Then there is that one about going on parade, in which the order of things is reversed so that the Drummer-boy comes on first and the Colonel last.

Well, of course, everyone knows that the stories are exaggerated. But how much? Exaggeration, like the weather, is a variable thing. And the main purpose of raking up these old tales is to draw attention to the fact that they indicate the importance which, in matters military, is laid upon procedure, or the correct way of doing things.

Now in the past (or, at any rate, for a number of centuries) only the Navy has fought from a home command. The Army has had to fight as an expeditionary force. And until this war (except for a small part of the air activity of the 1914-1918 war) the R.A.F. have also based their combatant squadrons (as distinct from Home Defence) on foreign soil. But this is a different kind of war, and the air force has big commands at home with lots of squadrons engaged on offensive combatant duties day and night; in fact, the R.A.F. units based in Great Britain have probably seen more fighting than the units based in France, while the units based outside these two zones have, so far, not seen a shot or shell fired in anger. To the R.A.F. units based in Britain (and part of the Fleet Air Arm) has fallen the lot of coping with the counter-attack duties against the German forces in Norway. So both the front and the area of activity for the air units in Britain have enlarged, while conditions in France have not yet altered.

Thus the idea, which is still largely held by the public, that the R.A.F. units in Britain are all home-defence units, must be rejected as false. The only genuine home-defence units based in Britain are the short-range fighters, which include all the single-seaters and the Defiant; plus the ground defences—guns, observers, searchlights and balloon barrage.

A *Complicated Situation*

At the present moment Britain is an arsenal defended by a home-defence force comprising land, sea and air units, but is simultaneously a base for air attack forces operating against German troops, naval and air units in Greater Germany, Poland, Norway and Denmark; this area might be enlarged at any moment; it may be some time before it is reduced.

Now, this situation is one which must produce complications. Germany has aeroplanes operating in close proximity to her land forces in Norway. Britain has not. The British air forces have to operate either from the British aerodromes hundreds of miles away from the units of the British land forces in Norway or from the decks of aircraft carriers cruising at some intermediate distance between the British and Norwegian coasts. This relative situation must continue until the British forces are able to obtain or construct land aerodromes in Norway, or make provision for the employment of flying boats or floatplanes by the creation of emergency seaplane stations in the Norwegian fjords.

Apart from its serious side, this situation is full of interest because it introduces a number of problems which deserve close scrutiny. I would say straight away that

The French still attach a great deal of importance to the observation balloon.

the Air Ministry has been found wanting in that it has failed to provide for such a situation. What answers are there to the following questions?: What fully equipped army co-operation aeroplanes are there which can co-operate with the British and French troops in Norway when these aircraft have to operate from aerodromes in Great Britain?

Remember that in the experience gained in the past, army co-operation aeroplanes took anything from two to four or five hours to complete co-ordination duties. For convenience in action army co-operation squadrons are generally placed as close to the front as possible, usually on more advanced aerodromes than fighters or bombers. Contact has to be established on the ground and in the air before, during and after every flight. How is it proposed to do this efficiently when the troops are in Norway and the aircraft in Britain?

At the moment of writing there might be three methods of partially overcoming this handicap.

One is the use of part of the Fleet Air Arm for army co-operation. This would mean detaching at least one aircraft carrier from naval duty and posting it to army duty. At least the suggestion possesses novelty, if not merit. Lack of merit is due to the fact that Fleet Air Arm pilots do not know anything about army co-operation, and it is no use posting army co-operation pilots to the ship, for they know nothing about ship flying. Again, R.A.F. army co-operation aeroplanes are no use as ship-planes because their span is too great for the lifts and their wings do not fold. Thus, the only possible aeroplanes for this job are the Swordfish, Albacore and Walrus, all belonging to the Fleet Air Arm, so back we come again to Fleet Air Arm pilots. Again, if the floating aerodrome were stationed close to the Norwegian coast, it might prove none too easy to defend from German air attack.

The whole essence of army co-operation is swiftness of inter-communication between aircraft and ground forces. The use of radio is essential. If army co-operation aeroplanes were to be used from a ship off the Norwegian coast, how would the radio communication be accomplished—via aircraft to ship and ship to shore, or direct from aircraft to a shore station? In any case, to maintain the necessary contact between the ground and air units, before and after flight, it would be necessary to have radio communication between shore and ship. This would disclose the ship's position to the enemy and make it easier for air attacks to be launched against the ship. And if the ship were to be damaged, driven off, or sunk, what happens to the army co-operation? If, for reasons of safety, a wireless silence is maintained between ship and shore and ship and aircraft, how can the necessary co-operation be carried out? It looks as though the first suggestion must be discarded.

The second suggestion is the employment of ski-planes from the surface of frozen lakes. Well, as the R.A.F. has no ski-planes, that disposes of suggestion number two. [The Norwegians have.—ED.]

The third suggestion is the employment of floatplanes or flying boats operating from the nearest open water to the troops with which co-operation is to be carried out. Here again the R.A.F. is handicapped by the comparative inattention which has been paid by the Air Ministry to the development and provision of floatplanes and units to operate them.

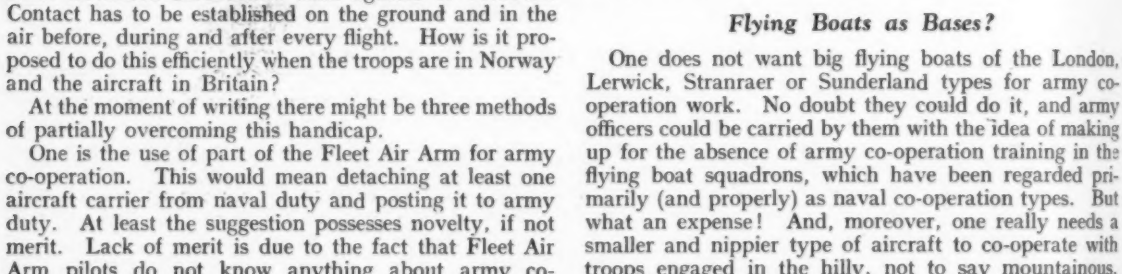
Flying Boats as Bases?

One does not want big flying boats of the London, Lerwick, Stranraer or Sunderland types for army co-operation work. No doubt they could do it, and army officers could be carried by them with the idea of making up for the absence of army co-operation training in the flying boat squadrons, which have been regarded primarily (and properly) as naval co-operation types. But what an expense! And, moreover, one really needs a smaller and nippier type of aircraft to co-operate with troops engaged in the hilly, not to say mountainous, country of Norway. And are there enough flying boats available to make possible their detachment from their present duties in order to assist the troops in Norway?

The floatplane side is probably even worse. How many floatplanes are available at the moment? How many trained floatplane pilots are there to fly them? How many pilots are there who combine knowledge of floatplanes and army co-operation?

If the floatplane side were not so poorly off, it might have been possible

Certain army co-operation squadrons are equipped with Bristol Blenheim IVs. These have a range of 1,900 miles.



Germany's slow-flying Fieseler Storch (right) is used extensively for army co-operation. Below is one of a small batch of direct-take-off Autogiros supplied to the R.A.F. before the war.

to equip a mobile army co-operation section of the R.A.F. with floatplanes and to make the air headquarters operate from a floating base provided by a flying boat, or more than one if need be. For example, there might be no better way to conduct some of the air headquarters work for such an army co-operation unit than from the air in a Sunderland. But, with things as they are, I am afraid there is little likelihood of putting such a suggestion into practice soon enough to be of any great value.

Thus it would appear that the Allied forces operating on land in Norway will have to carry on for some time without adequate air assistance of the kind which is technically known as army co-operation. And that is a pity. For in country of the kind in which the Allied forces will have to conduct a war of movement, efficient air co-operation is an invaluable factor.

The trouble is that all the Services are too watertight. And the one which ought to have been least hidebound by tradition has been dominated by the narrow outlook of the mind of the ground soldier ever since it has been in existence. Every Chief of Staff which the R.A.F. has ever had has been first a soldier. Pity! If only the Air Force had set out with the utmost determination to fit itself primarily for air campaigns—instead of reiterating *ad nauseam* the pernicious doctrine that no Service can act alone, but that all three are interdependent—it would be a more efficient Service to-day for the purpose of co-operation with the other Services. Anomalous, but true!

But it has been formulated, and upheld by the Air Ministry, that in a major war the R.A.F. cannot operate apart from the considerations of the other Services in accordance with the dictates of the Cabinet in regard to the conduct of the whole campaign. And it is in accordance with that thesis that the R.A.F. is equipped, to conduct orthodox warfare in accordance with the traditional codes of the two older Services, which have always managed to uphold their views in those political circles wherein the fighting Services are subordinated Departments of the Government.

Well, no army leader ever imagined that he might have to have air co-operation aeroplanes operating from bases hundreds of miles away from the ground forces, did he? Such an idea was pure heresy. And so the Lysander possesses a range of 600 miles, which is barely enough to take it over the North Sea and back without waiting for a moment on the other side. How then can it co-operate with army units in Norway when its nearest aerodrome is somewhere in Scotland? It can't. It just Can't.

What's going to be done? Is the Lysander going to be put on floats? Or is some other type going to be substituted until conditions make it possible for Lysanders to be used? Blenheims again, for instance, as in the case of long-range fighters? And if the second make-shift is employed, how are all the complications of ground co-operation going to be solved with 300 miles of sea between?

In the meantime the only thing the R.A.F. can do is to endeavour to obliterate its failure to provide against the very situation which has now arisen by attempting to prevent the German Air Force from carrying out those duties which the R.A.F. must find so impossible of facile accomplishment. And there is only one method by which the German army co-operation aeroplanes can be held down; that is by the bombing of every air base which they can use in Norway and Denmark so as to reduce them to a state of impotence. And by this act the R.A.F. may bring retaliatory bombing upon the aerodromes in Britain, for it is from British aerodromes that the process of extinguishing German air force army co-operation must be conducted.

Independent Action

The soldierly mind, visualising the military possibilities of the aeroplane, has failed to realise its possibilities of independent action. The naval mind has made the same mistake. The Admiralty most, and not far behind it the War Office, fought the air rearmament of Britain during the four and a quarter years of intensive rearming that preceded Mr. Chamberlain's declaration of war against Germany. Because of that opposition in the interests of their own Services, the Navy and the Army helped to make Britain's air force too small when the inevitable occurred (which almost all the politicians had said was not inevitable). Not only was the R.A.F. too small to wield a decisive effect on Power Politics, but its rearmament was directed towards the requirements of Navy and Army before the requirements of an Independent Air Force.

Now the time has come for the Air Ministry to place its own doctrine before the Cabinet, before the People (by suitable publicity), before the Admiralty and the War Office, and at long last to throw over the dogmatism of the military mind. In spite of all that has happened in this war so far, in spite of the quite obvious fact that in the main it has been (on Britain's side) a naval war, I am convinced that it will end when the power of the air arm can sway the issue to the point of victory. What we have seen is but the prologue. The real war has not yet begun. How is the R.A.F. to be used when it does begin? Will it have the right kind of aircraft for the job it may be called upon to do? These are questions I propose to explore in a subsequent article.

(Next week: Current Strategic Use of the Air Arm.)

B

An artistic picture of the Vanguard with an experimental Pratt and Whitney installation.

HIGH LOADINGS

The Vultee Vanguard : Rise in Wing Loading With Power and Armament

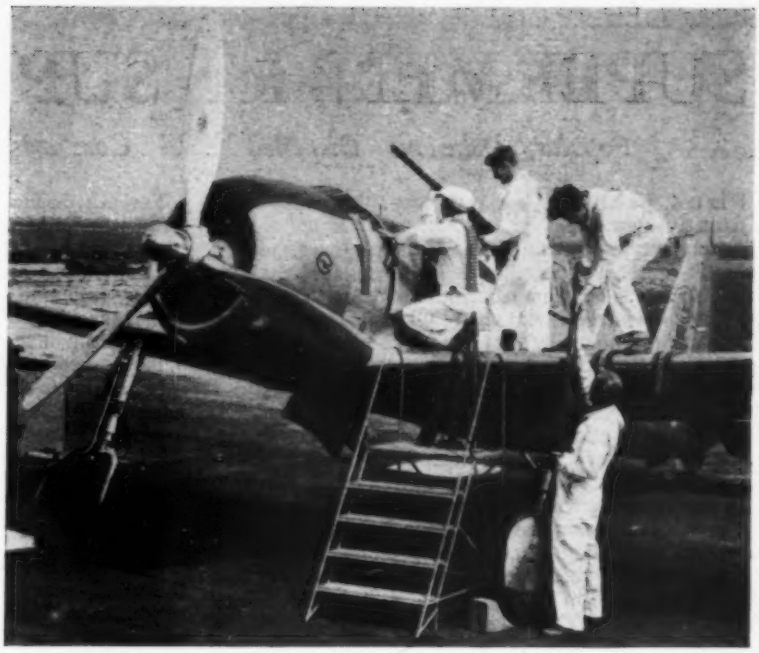
AMONG the new American military aircraft tried out by Wing Cdr. Addams, on behalf of the British Air Ministry, is the Vultee Vanguard single-seater fighter. This low-wing monoplane bears a marked resemblance to the machine in which Howard Hughes set up a world's speed record in 1935 by attaining 352 m.p.h., which is understandable, as both machines were designed by Mr. Richard Palmer. The first pictures of the Vanguard to appear showed it fitted with a Pratt and Whitney Twin Wasp with the new totally enclosed cowling, but the machine is now flying with a more conventional installation. Figures are also quoted for a version powered with the new Wright Two-row Cyclone, and it is intended ultimately to fit the Pratt and Whitney Double Wasp, of even higher horse-power.

Manufacturers' data issued for the Vanguard 48 powered with a Pratt and Whitney Twin Wasp S3C4-G engine include an empty weight of 4,657 lb. and a gross weight of 6,029 lb. The wing area is 197 sq. ft., which gives a wing loading of 30.6 lb./sq. 1t. These weights relate to the machine as armed with two Colt (Browning) 0.5in. machine guns with 250 rounds of ammunition each, the armament weight in this case being 252 lb. It has lately been stated, however, that the Vanguard can carry not only these two heavy machine guns, but eight additional rifle-calibre guns with about 4,000 rounds of ammunition. This additional armament would increase the all-up weight by something like 430 lb. and raise the wing loading to 32.77 lb./sq. ft., which is higher than that of the Messerschmitt Me 109.

With the Wright Two-row Cyclone, which gives 1,275 h.p.at 12,000ft. and weighs 1,950 lb., the all-up weight with the two heavy machine guns becomes 7,298 lb., and the wing loading is raised to 37.04 lb./sq. ft. The addition of the eight rifle-calibre guns would increase this further to 39.22 lb./sq. ft., which is very high indeed, particularly for a single-seater fighter.

No figures have been released for the Vanguard as fitted with the Double Wasp (1,450 h.p. at 16,000ft.), but the empty weight would be at least 7,648 lb. With the two 0.5in. guns this would give a wing loading of 38.8 lb./sq. ft., and the addition of the eight smaller guns would result in a loading of at least 40.49 lb./sq. ft. It is believed that the Double Wasp installation will be standardised with an airscrew extension shaft, so in all probability the gross

A demonstration of the rapidity with which the side panels of the Vanguard can be removed for inspection and servicing.



This view is alleged to show the installation of 0.5in. and 0.3in. guns in the Vanguard, but it will be noted that one of the small guns is not of the type used in fixed installations.

weight and wing loading will be considerably higher even than that.

According to the best available information, the Heinkel He 112 has a wing loading of only 34 lb./sq. ft., and this is considered by our designers to be dangerously high. The Hurricane is loaded to between 24 and 25 lb./sq. ft., and the Spitfire is very little siderably higher even than that.

Apparently the full armament load has not yet been installed on a Vanguard, certainly not on the Double Wasp version. An excellent series of publicity pictures lately issued shows mechanics alleged to be installing the armament. It is obvious on examination that the pictures were specially posed, for one of the guns shown has the handles associated with a free installation. The "blurb" reads as follows:—

"Believed to be the most heavily armed pursuit airplane of its type in the world to-day, the Vultee Vanguard pursuit can mount eight calibre 30 machine guns, firing approximately 4,000 rounds of ammunition, and two calibre 50 machine guns firing approximately 500 rounds of ammunition.

"Three of the 30 calibre guns are mounted in each wing, while two 50s and two 30s are installed in the fuselage and are synchronised to fire through the propeller field.

Barrel Removal

"It was learned to-day that Vultee armament engineers have succeeded in making it possible to remove barrels and internal mechanisms from each of the guns without having to remove the entire gun from its mountings. Heretofore, machine guns on most pursuit airplanes had to be entirely removed, causing delay in getting the airplane back into fighting service and also interfering with delicate sighting adjustments. The company's armament engineers believe that with this special provision for removing barrels and mechanism of all the guns it is possible completely to service the airplane's armament in from 10 to 15 minutes and have it ready for action."

Perhaps Mr. Palmer would care to submit for publication figures for the Vanguard carrying its ten guns and powered with the big Wright or Pratt and Whitney engine. Until that time we shall not comment further, but will briefly describe the structure.

The forward section of the Vanguard fuselage is of welded steel tubes, covered with quickly removable metal panels, but the rear section is of semi-monocoque construction. The wing is an all-metal cantilever type consisting of a rapidly detachable centre-section and two outer panels. In the centre-section are integral fuel tanks with a total capacity of 240 U.S. gallons. The undercarriage retracts into the centre-section ahead of the front spar. All exterior metal surfaces have butt joints and flush rivets.

Fitted with the Pratt and Whitney Twin Wasp $S3C4$-G engine (a two-speed supercharged model giving 1,050 h.p. at 13,100ft.), the Vanguard is claimed to have a top speed of 358 m.p.h. at 15,600ft. and to climb to 19,680ft. in 6.7 min. A service ceiling of 34,300ft. is claimed and the cruising range is said to be 580 miles on 144 U.S. gallons, though in overload condition, with 240 U.S. gallons, this may be extended to 1,800 miles. The span is 36ft., length 29ft. 2in., and height 9ft. 5in.

Californian sunshine enhances the attractive appearance of the Vanguard. As shown the machine has a Twin Wasp engine. This version is in production for Sweden.

Topics of the Day

SUPERMEN for SUPERCRAFT

Popular Delusions Dispelled : A Comparison in Technique

IT is not, perhaps, such a very queer thing that each entirely new type—as opposed to each individual machine type—should be considered as one requiring the attention of a super-pilot for its successful direction through the air. Such a superstition tends to be kept alive by successive generations of pilots and, in the case of military machines, by those pilots who are in the first squadron to be equipped with some new and harrowing device.

In the old days it was a sort of imposed superstition that flying of any kind demanded extreme skill, extreme courage and a special "birdman" attribute. Pilots themselves kept the superstition alive and it was not until the club movement appeared that Mr. Jones and Mr. Smith found that it was not the heart-rending and nerve-shattering affair that it was supposed to be.

More recently, therefore, the superman business has had to be reduced in its application to the pilots of certain types. When the Hart and Fury first appeared, for instance, we grovelled before the pilots who succeeded in flying them, though the test pilots insisted that they were too easy for words. Then came the Hurricane and Spitfire, with the unspoken understanding that only men of indomitable courage and outstanding physical fitness could be allowed to deal with them. Luckily, in this case, Capt. Balfour, the Under-Secretary of State for Air, proceeded forthwith to burst the balloon by flying them both and describing them as "old gentlemen's aeroplanes."

So they are. And in a general way the present-day devices are a good deal easier to handle than were the superior box-kites. The former can be brought in at almost any reasonable speed between 80 and 120 m.p.h. and still be put inside an aerodrome, while the latter would float all the way across if the odd ten miles an hour were accidentally added during a final sideslip. Not that anyone is advised to bring a Hurricane in at 120 m.p.h.; its bad for the flaps, the hold-off is less easy, and the aerodrome *may* not be big enough. But try bringing a Hind or a Gauntlet in at a velocity similarly higher than its landing speed—say, 100 m.p.h.—and you will pump-handle your way right across and into the boundary fence while the fire engine and ambulance chase you with clanging of bell and blowing of hooter.

Tackling the New Fighters

I was reminded of this old superman business by a sentence in a newspaper which told its readers that better and better fighters were coming along and remarked that pilots were already in training to enable them to cope with these projectiles, for the handling of which great endurance and strength were required. In a couple of years these aeroplanes will probably be used as intermediate trainers.

Not that I am denying the need for physical fitness and, more important, lots of practice in flinging these modern things about the sky for long periods. As a straight-and-level pilot I admit to greying myself out in a Spitfire, but I have done it much more successfully in a Gladiator—and even a Tiger Moth. I used the expression "greying" because, since I was not involved in mortal combat, there was no need to let the tightness of the turn be increased to the true blacking-out point.

You can, in fact, hold a Spitfire in an all-but-vertical turn, with the bank needle in the centre, without experiencing any particular discomfort, though it hurts your neck when raising your head to examine that part of the sky into which the machine is turning. The point is that machines are so strong and controls so powerful that such a balanced turn is by no means the limit. Start pulling, very gently, and the horizon goes grey, the speed begins to drop, and you ease out to feel a strange relief in tension. During that short few seconds you feel as if someone has clamped you in a tight-fitting suit of heavy armour with its only-just-transparent visor down.

Advantage of Flaps

Returning to the question of "difficulty" and taking the approach and landing as requiring the greatest degree of judgment, I must say that the modern type with flaps and a high wing-loading is very much easier, say, than a Swallow or a fully loaded Courier. The latter, in its day, was a very advanced type, but it has no flaps and is quite reasonably clean. An approach without engine required the greatest concentration as the speed must be held within 5 m.p.h. limits and the height within 50 feet limits. With a Blenheim, at the other extreme, you turn in a quarter of a mile from the boundary at 500ft., apply full flap and dive on to the ground. A variation of 200ft. or 20 m.p.h. makes very little difference since the flaps stop the float. The machine is almost dead as it is held off. Needless to say, it is normal to use a trickle of engine all the way down in order to flatten the approach and to reduce the tremendous change of attitude during the landing process. With so much artificial drag on modern machines you can't afford to flop around near the stall when away from the ground.

A certain hazard might be introduced by a variation in A.S.I. indications near the stall. Pitot-head position errors with thick wing sections are considerable at low speeds unless the head in question is pushed out on a long rod. As it happens, a flat figure of 85 m.p.h. (indicated) serves as a safe approach guide on 90 per cent. of the machines. Curiously enough, the same figure in knots works for two other types in which the A.S.I. is so calibrated. Nobody is going to tell me that the stalling speed of these last two machines is so much higher than that of the others; either these readings are high or the others are low—probably the latter. At least two very recent types must be brought in at an indicated 100 m.p.h., so perhaps airspeed indicators are becoming more accurate and a new standard figure must be decided upon for the benefit of ferry pilots. None of the readings mean much; the actual landing speed is very much the same for all of them—about 65 m.p.h.—but it is more than exciting if you find that a machine practically lands out of your hands at the speed at which, without worrying about it, you have been making approach turns.

I recommend the application of a red mark on the A.S.I. dial to indicate a good, average, safe approach speed for each machine. The test pilot can put it on after each acceptance flight. A little slip of red sticky paper is all that he needs to prevent any possibility of a serious sinking feeling.

INDICATOR.

"Flight" copyright drawing.

The Bréguet 691 may be identified by its heavily tapered wings and long engine nacelles which extend aft of the trailing edge.

justable gills on the trailing edge is a series of "pepper-box" exhaust outlets, and below each engine is a ducted oil-cooler.

Although the Bréguet is not normally used by *l'Armée de l'Air* as a fighter it may be of interest to point out that when equipped for fighting it can be armed with two 20 mm. high-velocity Hispano-Suiza shell-guns which fire out through the nose on each side, being mounted in such a position that it is possible to change their ammunition drums. In addition, there is a machine gun in the rear cockpit. Alternative forward armament is one shell-gun and two machine guns. In the ground-attack and bombing conditions the armament is, of course, lighter. Typically this would be one or two fixed rifle-calibre machine guns in the nose and a third on a pillar-type mounting at the rear, with the possibility of fitting a fourth to fire through the floor.

The bomber version has provision for eight vertically stowed 110-lb. bombs, or various combinations of smaller bombs for which traps are let into the bottom of the fuselage. Two-way wireless is standardised and a camera can be fitted if required.

The pilot is situated over the leading edge and has an unusually good view, while the rear gunner's position, which is provided with a retractable hood, is over the trailing edge. In this latter position the machine gun is arranged to fold down into the top fuselage decking.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

COLD-WEATHER FLYING

Difficulties Overcome in Canada

I HAVE just finished reading the article "War in the Air" in your issue of February 22, and was rather surprised at the distress experienced by the crews of bombers on account of the cold. I think that this difficulty could have been easily overcome, as we have had to overcome it whilst operating aircraft down North far beyond the Arctic Circle, even as far as the Arctic Ocean and across to Victoria Land. Forty-five degrees below zero is the everyday temperature during winter operations, and the lowest temperature recorded by the pilot whilst flying was sixty-two below zero. No amount of clothing would overcome this temperature, but artificial heat, supplied by simple modifications, has made these winter operations possible. Every pilot on these trips takes with him an air operations engineer, and it is these fellows who have brought into being these heaters which have made flying in temperatures of this kind possible. I feel sure that these fellows would be only too glad to give of their experience to help their fellow-military crews.

I personally remember the old days of the night raids with the Independent Air Force and the discomfort caused by the cold. But what a revelation to me to have worked and experienced these temperatures for the last twelve years and to see how the engineers have overcome them. I feel sure that the same ideas could be applied to military aircraft without lessening their efficiency and, at the same time, increasing the comfort of the crews.

As a matter of interest to you, fifty-two freighter aircraft operate from this airport down North to the sub-Arctic and Arctic, 1,500 miles of a run out, and carry every type of freight that you could wish to mention from Diesel engines to cases of fresh eggs, and the eggs delivered without being frozen.

JAMES A. BELL, Manager.

Municipal Airport,
Edmonton, Canada.

FAIR PLAY FOR THE NEUTRALS

Competition is Good for Trade

ONE of our British newspapers recently accused the neutral air transport companies of taking advantage of war conditions to go in for "trade grabbing." It is difficult to understand what, if anything, the writer of the article really had in his mind, unless he meant that on certain European routes the whole of the traffic had fallen into the hands of the neutrals because there was no British competition on those routes.

It is certainly not the business of K.L.M. or Sabena to enquire why there is no British competition on the Amsterdam or Brussels routes, but it is a commonplace of international aviation that the traffic between two countries may be, and ought to be, shared by the civil aviation of the two countries concerned.

There is no reason, then, why British services should not be in operation on these routes, but the fact is that no suggestion has ever been put forward about such services, and England, since the war commenced, has been served, and well served, by the air transport companies of Holland and Belgium, and until recently also by those of Sweden and Denmark, on the majority of the European routes.

When I say that England has been well served by these neutral air liners, I mean that despite difficulties and lack of facilities which cannot be helped in wartime, but which none the less make air traffic a more hazardous and less easy task than in peacetime these neutrals have provided the only existing air link, day after day with very great regularity, between this country and neutral capitals.

It is obvious that this fast link has been of incalculable value to very important interests in this country.

The various neutral air traffic concerns have been hard hit by the war, and many of their most flourishing routes have had to be abandoned. Nobody could blame them if they attempted to expand their air enterprise and to open up new routes.

As a matter of fact, the neutrals have opened up very few new lines since the war started. The only one I can call to mind at the moment is the K.L.M. line from Amsterdam to Lisbon via Oporto. This commenced on April 2, and British Overseas Airways commenced experimental lines to Lisbon about the same time, with a promise of a regular service about a month later.

If these two lines, British and Dutch, are competitive, as in some respects they may be, anyone who accused the Dutch of trade grabbing in this sphere would be treading on pretty delicate ground. Here is a case where both parties are perfectly entitled to operate their services, and any competition there may be is good healthy commercial competition, which should serve as a tonic to everyone concerned.

If perfectly legitimate trading enterprise is to be designated trade grabbing, many friends of commercial aviation in this country will feel inclined to press for a campaign of trade grabbing on the part of those whose concern it ought to be to foster British Civil Aviation during wartime.

"ONLOOKER."

THE "PUSH-PRODGE"

Major Barlow Refreshes Our Memory

READING your interesting article in the issue of *Flight* dated April 18 on the History of Marine Development, with special reference to Supermarines, prompts me to write you concerning one or two points.

The correct caption for the seaplane photograph on page *f* should be "A.D. Navyplane," an experimental seaplane 1916-1917, sponsored by the Air Division of the Admiralty. This was a seaplane only and was first fitted with the ill-fated

This photograph of the Pemberton Billing "Push-Prodge" has been sent to us by Major M. S. Marsden, who flew the machine in 1916. A comparison with the picture of the A. D. Navyplane published on p. *f* of our issue of April 18 shows that there were considerable differences between the two types.

"Smith" radial engine and later with the Bentley Rotary, which commenced life as the A.R.I. (Admiralty Rotary 1). The original flight trials of the seaplane were done by John Seddon (then Lt.-Commander). The figures in the photograph happen to be Scott-Paine and myself.

Incidentally, this design (under supervision of Harold Bolas, then with the Admiralty, in collaboration with Richardson and Mitchell (Schneider Cup) of Supermarines) had two interesting features. First, the pilot for reconnaissance and bombing duties had a complete sectional glass screen led round the nose of the nacelle from windscreen to under pilot's seat, giving a perfect view for the forward hemisphere. Secondly, the observer operated in addition to wireless a movable pivoted traversing gun mounting, the forerunner of certain modern types to-day.

T. M. BARLOW.

The Fairey Aviation Co., Ltd., Stockport.

[We are indebted to Major Barlow for sending us this interesting information concerning the A.D. Navyplane. He, of course, had much better opportunities to study Admiralty designs at close quarters than did *Flight* during the war 1914-18, and his reference to the transparent nose panel and the gun is particularly interesting in view of modern practice. Truly "there is nothing new under the sun."—ED.]

SERVICE AVIATION

Royal Air Force— *—Official Announcements*

The Duke of Kent

THE DUKE OF KENT has taken up an appointment as staff officer in the Training Command of the R.A.F. with the rank of Group Captain. To take up this post he has relinquished temporarily the rank of Air Vice-Marshal which he previously held. His duties will be in connection with the welfare of personnel.

V.R. Pilots Wanted

MEMBERS of the Civil Air Guard, and others, are now eligible for appointment to Commissions in the General Duties Branch of the R.A.F. Volunteer Reserve as pilots. They are required for aircraft engaged in non-operational flying, as flying instructors, ferry pilots and pilots of aircraft employed in the training of air observers, wireless operators and air gunners. Applicants must be between 28 and 48, have carried out at least 250 hours' solo flying, including recent experience on modern types of aircraft, and should preferably be holders of Class "B" Pilots' Licences. Forms of application may be obtained from the Air Ministry (S.7e(5)), Adastral House, Kingsway, London, W.C.2.

Accountant Officers

QUALIFIED accountants are required by the R.A.F., and commissions as accountant officers are being offered for the duration of hostilities. Those who wish to apply for appointment must possess full recognised professional qualifications and must be between the ages of 32 and 50. Applications should be made to the Under-Secretary of State, Air Ministry (S.7(e)5), Adastral House, Kingsway, London, W.C.2. It should be noted that the Schedule of Reserved Occupations does not operate with regard to professional men who wish to be employed in H.M. Forces in their professional capacity.

Casualties

THE Air Ministry regrets to announce the following casualties on various dates:—

KILLED IN ACTION.—P/O. A. Bryan-Smith (76003).

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED," NOW PRESUMED "KILLED IN ACTION."—A/C.1 A. Bathgate (567441); L.A/C. H. J. N. Marsden (528828); A/C.1 G. Rout (550531); F/O. J. A. C. White (39406); P/O. A. H. M. Wright (41643).

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—P/O. G. L. Norman (70871); A/C.1 R. B. Smith (520371); F/O. C. M. Wheatley (39147); Sgt. D. W. Wilson (566477).

WOUNDED OR INJURED IN ACTION.—P/O. W. E. Nicholas (43014); F/O. D. Phillips (90072); Sgt. C. F. Rose (565066); Sgt. L. W. G. Smith (523054).

MISSING, BELIEVED KILLED IN ACTION.—A./Cpl. A. S. G. Barrass (559095); A./Cpl. H. D. Brown (613213); F/O. M. W. Donaldson (37389); A./Cpl. J. H. Evans (532819); Cpl. W. H. G. Evans (566421); Sgt. J. Greet (580696); A./Cpl. A. C. Henry (621154); Sgt. W. J. Ison (580659); F/O. K. J. A. Johnstone (40229); A./Sgt. J. R. Jopling (550598); P/O. F. D. Middleton (40735); F/O. H. W. Robson (37759); F/O. W. G. Taylor (40155); P/O. M. Thomas (40648); Sgt. J. R. Tonkiss (564502); Sgt. S. V. Vart (580261).

MISSING.—Sgt. J. D. Aitchison (563022); P/O. P. D. Aldous (40582); Sgt. J. Atkinson (515180); Sgt. W. L. Balmer (564120); Sgt. L. Bancroft (562429); A/C.1 J. Booth (630373); Sgt. C. R. Bowen (562025); A/C.1 J. Boyd (619108); Sgt. R. G. Bruce (524136); Cpl. R. S. Bryson (524310); A/C.1 B. V. H. Bulmer (560834); Sgt. R. S. Callinan (580171); Sgt. P. Chivers (741732); A/C.2 R. M. G. Clark (618202); P/O. G. L. Crosby (40679); Flt. Lt. F. O. Dickson (33164); A/C.2 W. H. U. Dolley (648552); P/O. C. Edmunds (75997); Sgt. V. Emanuel (563090); Sgt. R. Etheridge (565877); F/O. A. R. Fordham (70220); A/C. 1 L. J. Fowell (622095); F/O. D. E. Gould (33312); A/C.1 P. G. Graham (551827); Sgt. G. Greenwood (566263); A/C.2 H. Greggans (641163); A./Flt. Lt. R. P. A. Harrison (37599); A/C.2 H. Harrott (618068); L.A/C. F. A. S. Haynes (610705); A/C.1 C. A. Hughes (333908); L.A/C. R. J. Lamb (536874); L.A/C. T. Liddle (568502); L.A/C. D. S. Lloyd (547593); L.A/C. N. McReynolds (522065); L.A/C. R. H. Mercer (546029); P/O. A. G. W. Merewether (41860); A./Flt. Lt. M. L. Morris (37866); Sgt. W. M. Mullally (580583); L.A/C. P. Murray (524858); L.A/C. E. W. J. Picot (364162); A/C.1 P. F. Ricketts (540110); A/C.1 G. E. Ridgway (611142); L.A/C. A. F. Roberts (522093); P/O. J. G. C. Salmond (33476); Sgt. J. R. Scarffe (529780); Sgt. G. H. Scott (566428); F/O. A. F. Smith (39346); A/C.2 E. B. Summerfield (615808); F/O. H. O. Thwaite (39399); F/O. C. F. L. Tulloch (39403); Cpl. G. A. Verlaque (525499); A/C.1 J. Wells (617573); L.A/C. J. L. Wilkin (534598); Sgt. E. H. Williams (580927); Sgt. R. H. Wills (580722).

KILLED ON ACTIVE SERVICE.—A/C.1 W. A. Augood (653108); A./Sgt. A. C. Catton (581499); P/O. P. A. L. Farrell (39866); A./Sgt. F. Graham (581508); Sgt. A. E. Hall (740183); Sgt. J. Holmes (748369); L.A/C. G. H. James (751999); Sgt. A. McPherson (748410); Sgt. L. A. Raper (516071); Sgt. A. F. Scott (743009); Cpl. C. E. Wilburn (534269).

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. P. Folkes (39076).

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. W. Bailey (764119); Sgt. L. A. Fieldhouse (740751); Sgt. R. S. Hutton (754874); Sgt. B. Pollard (564996); Sgt. H. Soar (748685); P/O. R. D. Wawn (41505).

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A./Flt. Lt. A. Alexander (36222); Sgt. J. Miskelly (740837).

DIED ON ACTIVE SERVICE.—A/C./Woman.2 D. E. Calder (889098); A/C.2 D. Flynn (548610); A/C.2 T. S. Hall (618078); A/C.1 G. W. Holmes (631536); A/C.2 E. A. L. Jones (654469); A/C.2 A. D. Menzies (633568); Sgt. A. G. H. Prior (562834); Sgt. V. B. Sinden (213336).

Anzacs' Gallipoli Parade

THE only Dominion flying unit on active service in Great Britain —No. 10 (Flying-boat) Squadron of the Royal Australian Air Force—commemorated Anzac Day, the anniversary of the landing at Gallipoli, at a Coastal Command station recently, before setting out on convoy escort and anti-submarine patrol far over the Atlantic.

In the parade were men who were in the landing on Gallipoli peninsula 25 years ago, while others were the sons of the original Anzacs.

Since the Australian Squadron began to function as a unit of Coastal Command two months ago it has flown a thousand hours and covered more than 140,000 miles on Atlantic patrol duties.

GOOD TRAINING AND GOOD SPORT: To instruct in the art of firing from a power-driven gun turret the pupils fire at clay pigeons with a twelve-bore sporting gun. Anyone conversant with clay pigeon shooting will realise how quickly these turrets can be traversed.

Service Aviation

Awards

THE King has been graciously pleased to approve of the following awards for gallantry displayed in flying operations against the enemy:—

DISTINGUISHED FLYING CROSS

HOMER, PILOT OFFICER MICHAEL GILES.

P/O. Homer was the pilot of an R.A.F. aircraft carrying out a high-level bombing attack on two enemy cruisers anchored in Christiansand Bay, South Norway. In the face of intense anti-aircraft fire and attacks by enemy fighters, he successfully pressed home his attack, and his air gunner shot down an enemy fighter that burst into flames and crashed into the sea. Although his aircraft had been damaged, P/O. Homer skilfully piloted it back to his base after a sea crossing of more than 400 miles.

DISTINGUISHED FLYING MEDAL

COLDICOTT, ACTING CORPORAL ALBERT DOUGLAS.

A./Cpl. Coldicott was the wireless operator and air gunner in P/O. Homer's aircraft during the above engagement and it was he who shot down the enemy fighter. By obtaining accurate bearings under difficult and harassing conditions he enabled P/O. Homer to navigate the damaged aircraft successfully to its home base.

WALLACE, CORPORAL JOHN.

Cpl. Wallace was wireless operator and air gunner in another R.A.F. aircraft engaged on the attack on enemy cruisers at Christiansand. They were attacked by nine enemy fighters, and Cpl. Wallace displayed the greatest gallantry and coolness in the face of repeated attacks by superior numbers and shot down one enemy into the sea. Under wireless instructions from the formation leader, Cpl. Wallace's aircraft escorted another that had been disabled until the latter was forced to alight on the sea. Corporal Wallace's accuracy in giving its position enabled a vessel to reach the scene and to effect a rescue.

POWELL, FLIGHT SERGEANT GORDON ALLEN.

Early this month, Flt. Sgt. Powell was captain of an R.A.F. aircraft taking part in a low flying attack on Stavanger aerodrome, Norway. This was pressed home with the greatest determination in the face of intense anti-aircraft and machine gun fire.

The aircraft received three direct hits, the first of which wounded Flt. Sgt. Powell in the shoulder and left side and severely damaged the aircraft. Immediately he was hit, Flt. Sgt. Powell dived near to the ground and made his escape to sea. Despite his wounds and loss of blood and the difficulty of controlling his damaged aircraft, he succeeded in reaching his home base, a distance of 370 miles, in extremely bad weather at night. His gallantry and devotion to duty were outstanding.

London Gazette

Royal Air Force

General Duties Branch.

The following are granted permanent commissions in the substantive rank of Flying Officer on the dates stated:—(Nov. 18, 1939) R. H. Warcup; (Dec. 15, 1939) A. R. Ll. Griffiths.

The following Pilot Officers on probation are confirmed in their appointments on the dates stated:—(Dec. 15, 1939) H. B. Kirk; (Jan. 2) A. R. Butcher; (March 5) R. Herrick; (March 20) P. J. Dorrington.

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers on the dates stated:—(Dec 28, 1939) R. A. Mosley; (Jan. 1) D. R. Keenan; (Jan. 19) R. C. Skellon, E. G. Spearing; (Feb. 20) J. Barker, J. G. Sandison; (Feb. 28) B. P. Legge; (March 9) A. S. Malcolm; (April 6) N. J. Brisbane.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation with effect from Dec. 4, 1939, and confirmed in their appointments Jan. 19:—A. W. Butler, A. R. Costello.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Nov. 6, 1939) R. J. P. Barber; (Jan. 31) W. G. Mellor; (Feb. 18) A. C. Sargent; (Feb. 20) P. D. Strong, C. S. Vos, L. L. Bartley, S. Ault, L. W. Basan, J. Beveridge, S. A. F. Bowen, S. G. Cooper, A. G. Crockett, A. Darling, J. L. Greves, T. A. Grundy, T. L. Hogg, G. I. Jerdein, N. M. H. Knowles, R. H. McDonald, P. Moller, G. D. N. Noel-Johnson, L. C. Quick, A. Tofield, A. T. Darling; (Feb. 24) D. H. F. Horner; (March 2) R. H. Barber, R. F. Forbes; (March 9) W. D. Mackley, A. F. Stidston, H. F. P. Newhouse; (March 24) A. D. Alexander, G. J. Drake, D. G. H. Reid, F. A. Robshaw, A. C. Rowe, B. Simpson, L. A. Stamer, W. B. H. Statham, P. C. Traill-Smith, D. A. Young, W. M. Lewis, G. I. Cherrington, D. J. Hammond, B. T. J. Newland, M. I. Nichols, J. P. Quirke, J. V. C. Wyllie, G. M. Goodman, J. S. Simson; (March 30) R. Reeve; (April 6) P. O. D. Allcock, G. R. Bennette, G. Bunce, A. R. McL. Campbell, P. A. Clough, W. J. O. Coleman, J. Curchin, J. H. H. Gladdis, D. Hastings, P. E. Henn, C. A. McGaw, M. A. G. Mason, A. G. Maycock, R. F. G. Miller, R. H. Morton, D. J. Spence, C. R. S. Rich, E. A. Tingey, W. L. Vickerstaff, J. K. Flynn, A. J. Pinhorn, A. H. Sanders, G. P. Welman, W. P. Hopkin, P. A. C. Jackson, L. E. Pearson, J. H. R. Young.

Flying Officer C. J. Donovan is promoted to Flight Lieutenant (April 12).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(Dec. 1, 1939) T. G. Bassett; (Feb. 3) P. S. Harvey; (Feb. 10) G. R. Taylor; (Feb. 29) J. O. Lalor; (March 24) A. J. A. Llewellin, K. F. Vare; (March 27) T. N. Silk; (April 12) T. H. V. Pheloung; (April 13) (seniority Nov. 30, 1939) P. D. Parry-Jones; (April 17) P. R. Burton-Gyles.

Air Commodore G. R. Bromet, D.S.O., O.B.E., is granted the acting rank of Air Vice-Marshal (March 4); Flying Officer E. J. Brooks (since promoted) is granted the acting rank of Flight Lieutenant (May 1, 1939). (Substituted for notification in *Gazette* of Aug. 22, 1939.)

The following Flying Officers relinquish the acting rank of Flight Lieutenant on the dates stated:—(Aug. 6, 1939) L. A. G. S. Lewer (since promoted); (Aug. 14, 1939) R. E. Craven (substituted for notification in *Gazette* of Aug. 22, 1939); (Nov. 12, 1939) J. N. W. Farmer (since promoted); (March 17) W. E. Williams; (April 15) J. R. Pennington-Legh.

The following are placed on the retired list on account of ill-health on the dates stated:—(April 13) Wing Comdr. A. C. Bayley; (April 16) Squadron Leader J. H. McN. Campbell.

The notification in *Gazette* of Feb. 20 concerning Flight Lieutenant H. Stafford is cancelled; the notification in *Gazette* of April 2, concerning Flying Officer J. MacL. H. Sinclair is cancelled; the notification in *Gazette* of April 9 concerning Pilot Officers on probation J. M. Wilkin and R. A. Kirkwood is cancelled.

Equipment Branch.

Warrant Officer A. Hall is granted a commission for the duration of hostilities as Flying Officer on probation with effect from April 10 and with seniority of Feb. 29.

The following Pilot Officers on probation are confirmed in their appointments with effect from the dates stated and promoted to the rank of Flying Officer (March 27):—(Jan. 2) A. L. Cornford; (Jan. 23) J. J. Dutton.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer (April 3):—G. L. Lister, E. L. Macro, L. F. Styles.

Acting Pilot Officer on probation J. F. Morgan is graded as Pilot Officer on probation (March 29).

The following Flying Officers are promoted to the rank of Flight Lieutenant (April 12):—H. Lovegrove, J. S. Eley, F. H. J. Heading, D. Stacey, A. C. Thorne, H. F. Thomas, M.B.E., E. F. Curtis, D. Yellowley, E. A. Rabbitts.

The following Pilot Officers are promoted to the rank of Flying Officer (March 27):—E. D. Bradfield, M. Collinson, M. E. L. Hobden, H. R. E. Rumsey, D. C. Walker, H. C. D. Blasbery, R. S. Burles, G. R. Cook, G. P. Howell, G. D. Mitchell Dawson, C. C. Murdoch, J. E. T. Murphy, C. Murray, P. J. H. Perkin, A. Sloan.

Medical Branch.

R. Macpherson, M.R.C.S., L.R.C.P., is granted a short service commission as a Flying Officer for three years on the active list, and is seconded for duty at St. Bartholomews Hospital (Feb. 1); Miss A. M. Clark, M.D., B.S., M.R.C.S., L.R.C.P., is appointed as Medical Officer with the relative rank of Flying Officer (April 2).

Errata.

In *Gazette* of April 2, for Lieutenant Christopher Ronal Alastair Forsyth read Lieutenant Christopher Ronald Alastair Forsyth, and for Second Lieutenant Roger Montague Dickenson Hall read Second Lieutenant Roger Montague Dickinson Hall.

Princess Mary's Royal Air Force Nursing Service

The following Staff Nurses are promoted to the rank of Sister on the dates stated:—(March 1) Miss I. M. Chapman; (March 6) Miss D. E. Wood; (March 8) Miss E. Smyth; (March 14) Miss A. Russell; (March 15) Miss I. M. L. Barnes; (March 28) Miss I. E. W. Lewer; (March 31) Miss F. H. Willcox.

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—(Sept. 3, 1939) L. H. Ridley, A. D. L. Carroll, C. W. Cudemore, M.C., D.F.C., T. F. Steele, H. A. Love, C. L. Lowe, D.F.C., F. J. Brunton, D. L. Townsend, L. E. Falla, C. G. M. Anderson, T. B. Fenwick, V. G. H. Gee, C. R. Cubitt, J. D. Sinclair, F. B. Tomkins, B. E. Moody, A. W. Whitta, L. H. Mason, A. F. Merritt, E. C. Foreman, E. D. Turner, W. E. Hall, W. E. W. Grieve, A. L. Mortimer, R. S. Munday, C. C. D. Williams, H. P. Hudson, R. G. Weighill, L. S. Tindall, T. J. Davidson, N. W. Creasy, C. W. F. Carter, F. C. G. Freeman, R. E. Watts, G. A. E. Harkness, J. R. Ayling, T. R. Hope, H. T. Lines, S. P. Richards, A.F.C., G. S. King, M. P. O'Reilly, R. P. Garnons Williams, A. E. V. Mathias, T. H. Wilson, D. A. Messiter, M. E. Pickford, K. N. Sayers, C. F. Fyfe, F. B. H. Hayward, I. O. Baldwin, L. E. Dalrymple, A. R. T. Coke, J. Bamber, G. J. Holland, W. E. L. Lewis, L. W. V. Jennens, L. E. R. Stonhill, T. A. Jefferson, G. V. Barber, C. H. Mallinson, H. D. Raynham, R. D. Adams, D. G. Ross, B. P. A. Vallance, E. J. Hill; (March 20) E. J. Gracie.

Flt. Lt. A. R. Hughes, M.B.E., is granted the rank of Squadron Leader (Dec. 18, 1939); F/O. W. J. Hutchinson is transferred to the Administrative and Special Duties Branch (Feb. 1); Flt. Lt. D. M. Newman relinquishes his commission on appointment to a commission in the Indian Army (U.L.) (March 15); F/O. E. P. Whitfield relinquishes his commission on completion of service (July 9, 1939); F/O. E. L. Shankland is cashiered by sentence of General Court Martial (April 2).

Royal Air Force Volunteer Reserve

General Duties Branch.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—(April 4) H. S. Shield. Sergeants: (April 7) W. A. K. Carr, N. H. Carrier, R. J. Carter; (April 11) A. P. Burdett, A. R. Carrick, D. Crowley-Milling. Leading Aircraftmen: (March 10) R. Brown, A. G. Middleton; (March 24) G. S. Hebron, D. C. Howe, A. W. Martin, A. H. Murphy, E. C. Schollar, H. R. Sharman, F. N. Thompson, D. A. P. Warren, M. L. Wells, F. J. Brayley, D. Kidger; (March 27) M. D. Green, W. C. Hall, N. B. Shorrocks, G. W. Spiers, H. K. Wakefield, W. A. H. Watson.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—(Feb. 1) D. W. Hogg; (Feb. 5) R. J. Falk; (March 17) L.A./Cpl. D. E. Patterson, J. Turnbull, R. C. Sterling, D. A. Strachan, J. J. Tozer, W. Murray, A. McLaggen. (Substituted for notification in *Gazette* of April 9.)

The following are granted commissions for the duration of hostilities as Acting Pilot Officers on probation:—(March 26) A. Findlay-Fleming, F. Holmes, J. O. Mair, J. F. Palmer, M. H. Pinder, E. Reeve, R. T. Sheppard, C. C. Sherring, C. R. Watson.

Acting Pilot Officer on probation F. E. Jones is transferred to the Administrative and Special Duties Branch and graded as Pilot Officer on probation (Jan. 8); P/O. E. E. Barber relinquishes his commission on account of ill-health (April 17).

Administrative and Special Duties Branch.

Flt. Lt. J. A. Smith is granted a commission as Flight Lieutenant with effect from Sept. 1, 1939, and with seniority of March 2, 1939. (Substituted for notification in *Gazette* of Nov. 28, 1939.)

The following are granted commissions as Flying Officers with effect from Sept. 1, 1939, and with seniority of the dates stated:—(April 5, 1937) E. W. Barry; (Sept. 20, 1937) Lt. Cdr. K. M. Lloyd-Jones (R.N.R.).; (Dec. 5, 1937) Lt. Cdr. A. T. C. Cooper (R.N.R.); (Feb. 7, 1938) Lt. R. D. W. Mackay (R.N.R.); (July 25, 1933) Lt. E. W. T. Hardie (R.N.R.); (Nov. 14, 1938) W. Batey; (July 17, 1939) W. S. Miller. (Substituted for notification in *Gazette* of December 26, 1939.)

J. B. Clarkson is granted a commission as Flying Officer for the duration of hostilities with effect from Sept. 6, 1939, and with seniority of Aug. 14, 1939. (Substituted for notification in *Gazette* of Dec. 26, 1939.) K. Ellis is granted a commission as Flying Officer for the duration of hostilities with effect from Sept. 18, 1939, and with seniority of Sept. 4, 1939. (Substituted for notification in *Gazette* of Dec. 26, 1939.) G. F. L. Coates is granted a commission as Flying Officer with effect from Sept. 1, 1939, and with seniority of July 17, 1939. (Substituted for notification in *Gazette* of Jan. 5.) H. F. G. Dainty is granted a commission as Flying Officer for the duration of hostilities with effect from Oct. 13, 1939, and with seniority of Sept. 26, 1939. (Substituted for notification in *Gazette* of Jan. 5.) J. L. Scott is granted a commission as Flying Officer for the duration of hostilities with effect from Dec. 5, 1939, and with seniority of Nov. 13, 1939. (Substituted for notification in *Gazette* on Jan. 5.) Lt. E. H. Roberts (R.N.R., Retd.) is granted a commission as Flying Officer with effect from Sept. 1, 1939, and with seniority of Nov. 22, 1937. (Substituted for notification in *Gazette* of Jan. 5.)

The following are granted commissions for the duration of hostilities as Pilot Officers on probation with effect from the dates stated and with seniority of Feb. 1:—Acting Sergeant: (March 5) J. E. Harley. Acting Corporal: (Feb. 17) A. E. C. Vanderfelt.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation with effect from the dates stated and with seniority of Feb. 15:—Acting Sergeant: (March 6) A. M. Morgan. Corporals: (March 4) S. E. Mann; (March 26) F. C. Davis. Leading Aircraftman: (March 4) M. L. Arnold. Aircraftman 2nd class: (March 13) J. B. Tanner.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated.—(Feb. 11) G. J. H. Lascelles; (Feb. 25) L. S. Wigdortchik; (March 5) H. A. Chippindale, M.C.; (March 11) L. G. Blomfield; (March 15) C. D. Bennett, G. B. Harding, E. Hosey, F. A. Ledgard; (March 18) W. E. Cater; (March 21) G. R. C. Dunhill, R. J. Sayle, C. R. Whytt; (March 26) J. T. Histed; (March 27) W. A. Tarry, S. P. Williams; (March 28) D. F. Meredith; (March 31) J. D. Atcherley, L. Cushion, J. L. S. Fry, F. C. Jones, T. A. Rose, K. B. S. Willder, R. C. M. Young; (April 1) W. E. Bryan, E. R. Crowther, R. A. V. Dismore, W. E. Duckfield, M. J. Fenwick, G. L. Godden, O.B.E., B. V. Grealy, R. C. Green, P. Jackson, L. E. Russell; (April 2) G. R. Bowes-Cavanagh, C. F. Cowper, A. H. Greatrex, E. N. Lohmeyer, D.F.C., R. T. Mark, M.C., G. N. Snowball; (April 3) A. Boyle, M.C., A.F.C., I. C. D. Clowes, Lord George Heneage Lawrence Dundas, R. Gore, W. D. Hall, M.C., R. C. Wright; (April 4) P. D. Abbott, R. F. Freeman, S. Lunt; (April 5) S. J. D. Acland, R. G. Mitchell, E. D. Syson, F. Taylor, J. H. Thomas; (April 8) R. M. D. Anderson, C. E. Armand, F. L. Champanhac, R. M. C. Day, R. G. E. Diamant, J. I. Eadie, A. J. Graham-Wigan, L. F. Hartje, C. A. Henning, A.C.L. D. Lees, W. F. Lowe, R. J. S. Land, P. C. Martin, J. Meguer, A. C. Minassian, E. C. Nock, W. A. Sime, R. B. Snagge, A. Thomson, W. J. C. Tonge, W. W. Watson, F. F. Wessell, N. Zambra.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation for duty as Deputy Assistant Provost Marshals (Nov. 27, 1939):—F. E. Hixson, W. J. Rivers. (Substituted for notification in *Gazette* of Dec. 26, 1939.)

The following are granted commissions for the duration of hostilities as Acting Pilot Officers on probation (Jan. 2):—D. F. Brooks, G. R. L. Gaunt.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated:—(Aug. 30, 1939) F. Buckby. (Substituted for notification in *Gazette* of Oct. 27, 1939.) (March 13) O. C. Morison.

F/O. W. S. Felding-Johnson is transferred to the General Duties Branch (Oct. 30, 1939). (Substituted for notification in *Gazette* of Jan. 5); P/O. D. Garnett resigns his commission (March 4); Flt. Lt. H. C. Fuller relinquishes his commission on account of ill-health (April 17); the notification in *Gazette* of April 2 concerning F. E. Hixon and S. G. River is cancelled.

Equipment Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Flight Lieutenants: (March 28) Maj. A. S. Fraser; (April 1) Cdr. L. C. Lawrence (R.N. Ret.). Pilot Officer on probation (Sept. 6, 1939) A. W. Bayley. Acting Pilot Officers on probation: (April 2) T. N. Alderdice, J. H. Andrew, J. P. Andrews, F. T. H. Anelay, W. S. Baddeley, S. L. Baker, J. G. Bewley, E. C. Bolton, J. E. C. Botham, H. Bowman, S. J. T. Bryer, J. D. Carmichael, A. McN. Chassels, J. W. Clegg, D. Crabtree, R. Crittenden, C. B. R. J. B. Curtis, J. B. Dixon, I. G. H. Drummond, B. A. C. Duncan, A. N. Dupont, R. E. H. Fender, R. L. Frith, P. M. Gilmore, S. Goatcher, H. H. Godecaux, R. A. Heppenstall, A. H. P. Holliss, G. T. Honniball, R. C.-H. Horne, E. H. Isaacs, H. B. Johnson, L. T. Kinchin, L. B. Kingsbury, K. R. Laing, J. Lea, W. M. Lloyd, I. Macfarlane, B. E. J. McSweeney, S. Miller, E. J. Milner, R. A. Milsom, D. Mitchell, E. J. Morris, S. W. G. Morton, G. C. Murray, H. Peat, E. W. Piggott, R. G. G. Ponsonby, E. A. Pratt, J. R. Pryor, H. B. Sissmore, C. B. Skipper, G. C. Stonley, W. F. Tuckwell, J. P. Usher, B. G. Warnes, J. Whitwell, L. Wilk.

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—(Nov. 24, 1939) H. K. H. Dale; (Nov. 27, 1939) E. R. Smouha. (Substituted for notification concerning these officers in *Gazette* of Dec. 26, 1939). (Dec. 13, 1939) R. C. Woodland; (Dec. 20, 1939) R. P. Hewgill. (Substituted for notification concerning these officers in *Gazette* of Jan. 19.)

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Feb. 7) A. C. Featherstone; (Feb. 12) R. V. Gray; (Feb. 20) H. L. Bray; (March 14) L. O. Devonald.

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(Jan. 19) A. Beare; (March 13) D. McArthur, E. Huntley, A. W. Pim, L. N. Saw; (March 20) J. Heard; (March 27) R. V. Whittaker; (April 25) G. B. Howard-Rice.

F/O. K. W. Graham is transferred to the General Duties Branch (March 2).

Accountant Branch.

P/O. on probation G. S. Stone is transferred to the General Duties Branch (March 2).

Medical Branch.

The following Flying Officers are promoted to the rank of Flt. Lt. (April 4):—J. S. Brocket, M.B., Ch.B.; J. A. Chalmers, M.B., Ch.B.; C. E. Elliott, M.R.C.S., L.R.C.P., M.B., B. Chir.; G. A. Fraser, M.B., Ch.B., D.L.O.

Meteorological Branch.

D. F. Bowering is granted a commission for the duration of hostilities as Flying Officer (Oct. 31, 1939). (Substituted for notification in *Gazette* of Nov. 14, 1939.)

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—(Nov. 24, 1939) A. E. Chapman; March 26) B. Hanks.

Chaplains' Branch.

The following are granted commissions for the duration of hostilities with the relative rank of Squadron Leader on the dates stated:—(March 7) The Rev. E. A. P. D'Arcy; (April 2) The Rev. G. H. D. Davis, M.A.; The Rev. A. Maclurg, B.A.

Legal Branch.

The following are granted commissions for the duration of hostilities as Flight Lieutenants on the dates stated:—(April 8) C. J. T. Pensotti; (April 9) H. R. Griffith, M.A.

Errata.

In the *Gazette* of December 12, 1939, for W. H. N. Shakespeare read W. H. N. Shakespeare, M.C., A.F.C.; the notification in *Gazette* of Jan. 5, concerning J. V. West should have appeared under the heading "Accountant Branch" and not "General Duties Branch"; in the *Gazette* of March 26, for M. G. Milson, M.C., read M. G. Milsom, M.C. (77868).

Auxiliary Air Force

General Duties Branch.

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers on the dates stated:—(Aug. 29, 1939) G. W. L. Jackson, Baron Allerton; (Sept. 3, 1939) Q. O. Sansbury, W. G. H. Hedges; (March 2) H. S. L. Dundas; (March 17) D. E. Teden, D. K. A. Mackenzie, W. A. Douglas, A. E. Davies, I. K. S. Joll, A. Obolensky, D. A. Braithwaite, S. G. Fenwick, J. Robinson, the Hon. P. I. Cunliffe-Lister, A. R. Cousins; (March 23) S. P. Parnall, R. C. Greenlees; (April 6) T. B. Murray, J. Brewster, L. H. Casson, J. B. Hatchwell, A. L. B. Raven, J. R. G. Sutton, T. D. Williams, W. P. Barrell.

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(Sept. 7, 1939) W. H. R. Whitty; (Oct. 8, 1939) L. Fredman; (Nov. 1, 1939) A. G. P. Brightmore; (Nov. 30, 1939) A. D. Forster; (Dec. 28, 1939) M. E. A. Royce; (Jan. 26) A. Eyre.

A.P/O. W. G. Williams relinquishes his commission on account of ill-health April 16).

Equipment Branch.

The following Flight Lieutenants relinquish their commissions on appointment to commissions in the Royal Air Force Volunteer Reserve (Sept. 1, 1939):—F. T. Stacey, H. C. Fuller.

The following Flight Lieutenants relinquish their commissions on recall to the Royal Air Force on the dates stated:—(Sept. 1, 1939) H. F. Webb, G. J. Maygothling; (Sept. 12, 1939) F. J. B. Powell.

Flt. Lt. H. M. Pim relinquishes his commission on cessation of duty (April 19).

Medical Branch.

F/O. A. M. Boyne, L.R.C.P., L.R.C.S., L.R.F.P.S., is promoted to the rank of Flight Lieutenant (March 3).

Women's Auxiliary Air Force

The following are appointed Assistant Section Officers (April 18):—Aircraftwoman 2nd Class Mrs. V. A. Anderson, Sergt. Miss J. Durlacher, Corpl. Miss M. F. Ralston, Aircraftwoman 2nd Class Mrs. L. H. Rankin, Aircraftwoman 2nd Class Miss L. M. Robertson, Aircraftwoman 2nd Class Miss N. A. Sapte, Aircraftwoman 2nd Class Mrs. L. M. Stewart, Aircraftwoman 2nd Class Miss A. R. Tainsh, Corpl. Miss M. A. Tebbs, Corpl. Miss J. I. Whittome, Sergt. Miss J.-M. Williamson, Aircraftwoman 2nd Class Miss N. E. Woodhead.

Assistant Section Officer Mrs. K. Biddle relinquishes her appointment on account of ill-health (April 15).

The following relinquish their appointments on the dates stated.—Flight Officer (March 6):—Mrs. J. C. Fleming. Assistant Section Officers (March 16):—Miss J. Oram; (March 22) Mrs. E. H. Austin; (April 14) Mrs. D. G. Johnson.

Maharaja of Jodhpur's Gift

THE Royal Air Force Benevolent Fund has received a donation of £500 from Air Commodore His Highness the Maharaja of Jodhpur, G.C.S.I., G.C.I.E., K.C.V.O.

Engineer and Technical Officers

THE Royal Air Force requires a number of technical officers for employment on engineering, armament, and signals duties. Commissions in the Royal Air Force Volunteer Reserve will be granted for the duration of hostilities to suitable applicants between the ages of 21 and 50 years possessing the requisite personal and technical qualifications. Applications are invited from persons with the following minimum qualifications:—

Engineer.—(i) Holders of Engineering Degrees. (ii) Holders of Engineering Certificates, or members of Engineering Institutes who also have two years' practical experience. (iii) Practical engineers who have served an apprenticeship followed by a number of years' experience in erecting or overhauling internal combustion engines or aeroplane structures, and with knowledge of the properties of engineering materials.

Armament.—(i) Holders of Engineering Degrees or Engineering Certificates, or members of Engineering Institutes with at least two years' practical experience, particularly those with experience in armament manufacture. (ii) Practical engineers who have served an apprenticeship followed by a number of years' practical engineering experience and with knowledge of the proportion of engineering materials.

Signals.—(i) Holders of Engineering or Science Degrees. (ii) Holders of Technical College or approved Institute Diplomas, and two years' experience in telecommunications engineering (preferably on the radio side). (iii) A number of posts is also available for candidates possessing a sound theoretical knowledge of elementary electricity and magnetism, of the principles of wireless telegraphic and telephonic communications and of transmitter circuits, modern wireless receiving apparatus, and apparatus for the measurement of high-frequency potentials and currents. Some practical experience in addition is desirable, and specialised knowledge in one or more of the practical aspects of telecommunications would be an asset.

Candidates who possess the requisite qualifications and who are selected for commissions will be entered in the newly-formed Technical Branch of the Royal Air Force Volunteer Reserve in the rank of P/O. on probation. They will be eligible for confirmation in their appointments and for promotion to F/O. after one year, if recommended. F/O. will be promoted to Flt. Lt. after three years' service as F/O., if recommended. The present minimum rates of pay, which are the same as those issuable to officers of the General Duties (Flying) Branch, are as follows:—P/O. £264 a year, F/O. £331, Flt. Lt. £396. Accommodation, rations, etc., or cash allowances in lieu in each case.

Provision is also made for allowances in respect of the families of married officers. An outfit grant (normally £40) is issuable on entry.

Candidates whose qualifications do not reach the high standard required of officers of the Technical Branch, but whose services can be utilised on "Special Duties" of a technical character, may be offered commissions in the Administrative and Special Duties Branch of the Royal Air Force Volunteer Reserve. Entrants into this Branch will receive the rank of Acting P/O. on probation (if requiring initial training) or P/O. on probation (if suitable for immediate posting to a service unit). Acting P/O. will be regarded as P/O.s on posting to a service unit on completion of training. P/O.s will be promoted to F/O. after one year's service as P/O., if recommended. Promotion beyond F/O. will be by selection.

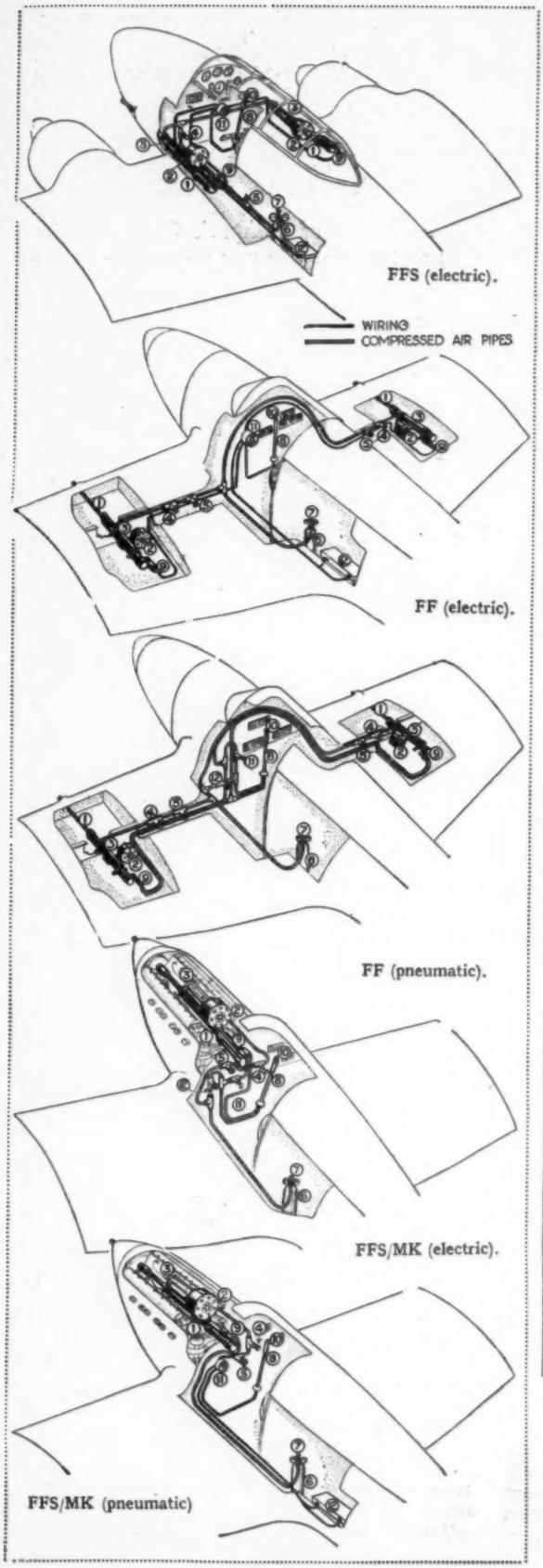
The present minimum rates of pay are: A./P/O. £182 a year, P/O. £215, F/O. £246, Flt. Lt. £346. Other benefits in cash or kind as stated above.

Candidates should apply at once, in writing, to the Air Ministry, S.7.c.5, Adastral House, Kingsway, W.C.2, giving full particulars of their qualifications, training and experience. Personal calls and telephone enquiries should be avoided.

Candidates who are engaged on the production of aircraft, engines or accessories, or on other important national work, should not submit applications without first consulting their employers as to the possibility of their being spared for Royal Air Force duty.

Selected applicants will be required at a later stage to attend for examination by Selection Board, Technical Board, and Medical Board in London at their own expense.

ROYAL AIR FORCE NUMBER, May 9, 1940



MODERN SHE

The Oerlikon Series for Aircraft, Anti-Aircraft and Infantry Use

THAT shell-firing armament for aircraft is not a passing "craze" but a modern necessity can hardly be doubted. This, of course, does not mean that multiple machine guns are thus rendered completely obsolete, for these may still have an important application in "dog-fighting," but to achieve greater destructive power, range and penetration recourse must be made to projectiles of larger bore.

In view of the current interest *Flight* is glad to be able to publish detailed information on the comprehensive range of 20 mm. shell-firing guns manufactured by the Oerlikon Machine Tool Works, Zürich-Oerlikon, Switzerland. These guns are notable in that they operate on the "mass-closing breech" principle. The energy imparted by the recoil spring to the breech block on its forward stroke nullifies a portion of the back pressure of the powder gas at the instant of ignition, i.e., when the breech head has pushed the cartridge firmly home until it is safely enclosed on all sides within the chamber, thus achieving gas-tight closure. The remaining back-pressure drives the breech block rearward again.

Smooth Operation

This repulsion is effected against the tension of the recoil spring, which—on reaching its maximum tension—causes reversal of the breech block in its rear end position and drives it forward again. As the breech block is thus received on its forward reversal by the gas cushion formed between the base of the bullet and the case, and on its rear reversal by the recoil spring, the gun works very smoothly. The weapon is designed both for single or automatic fire. In automatic fire the process already described is repeated until the magazine is emptied. In single fire, after each shot the breech is maintained in the cocked position and no

TECHNICAL DATA

Characteristics	Wing Guns			Engine Gun
	FF	FFL	FFS	FFS MK
Calibre ... ... mm	20	20	20	20
Length of barrel in calibres	38	60	70	70
Number of grooves	9	9	9	9
Angle of rifling, constant to the right ...	7°	6°	5°	5°
Maximum gas pressure ... ... at	3200	3200	3200	3200
Muzzle velocity ... ... m/sec.	600	750	830	830
Rate of fire ... ... min.	520	500	470	470
Total length ... ... mm	1349	1879	2118	2169
Maximum height ... ... mm	158	179	201	170
Maximum width ... ... mm	174	198	213	137
Weight of the gun without magazine ... ... kg	23	36,0	46	49,5
Weight of 30-round drum magazine, empty ... ... kg	6,5	7,2	8,3	8,3
Weight of 45-round drum magazine, empty ... ... kg	7,6	8,3	9	9
Weight of 60-round drum magazine, empty ... ... kg	8,3	9,3	11,3	11,3
Weight of cartridge ... ... kg	0,193	0,211	0,240	0,240
Weight of projectile ... ... kg	0,124	0,124	0,124	0,124

Twin and single gun installations are shown on the left. The key numbers indicate the various components, (1) Gun, (2) Drum magazine, (3) Pneumatic cocking device, (4) Valve for pneumatic cocking device, (5) Shut-off valve for cocking device, (6) Compressed air bottle, (7) Air reduction valve with pressure gauges, (8) Control stick, (9) Electric, or pneumatic, trigger control according to type, (10) Button for electric trigger control, (11) Switch, (12) Storage battery. (In all cases cocking is pneumatic).

HE GUNS

new cartridge is introduced into the chamber. After firing the last shot a special device causes the breech to remain in its rear cocked position and makes it impossible to actuate the trigger with empty magazine.

The simultaneous loading of two cartridges or the loading of a round while there is any foreign matter in the loading chamber—as may happen with automatic weapons—is prevented by a simple device which locks the repeating mechanism.

The barrel is cooled by air and is provided with cooling fins for the purpose. The air is constantly renewed by the movement of the breech block.

There are three fashions in which the Oerlikon guns can be applied to aircraft: they may be fixed in the wings or fuselage; mounted so as to fire through the airscrew shaft of an engine; or fitted to free mountings, usually in the nose or tail. According to requirements the guns are made in three types:

Light model, Type "FF," with 600 m/sec. initial velocity.

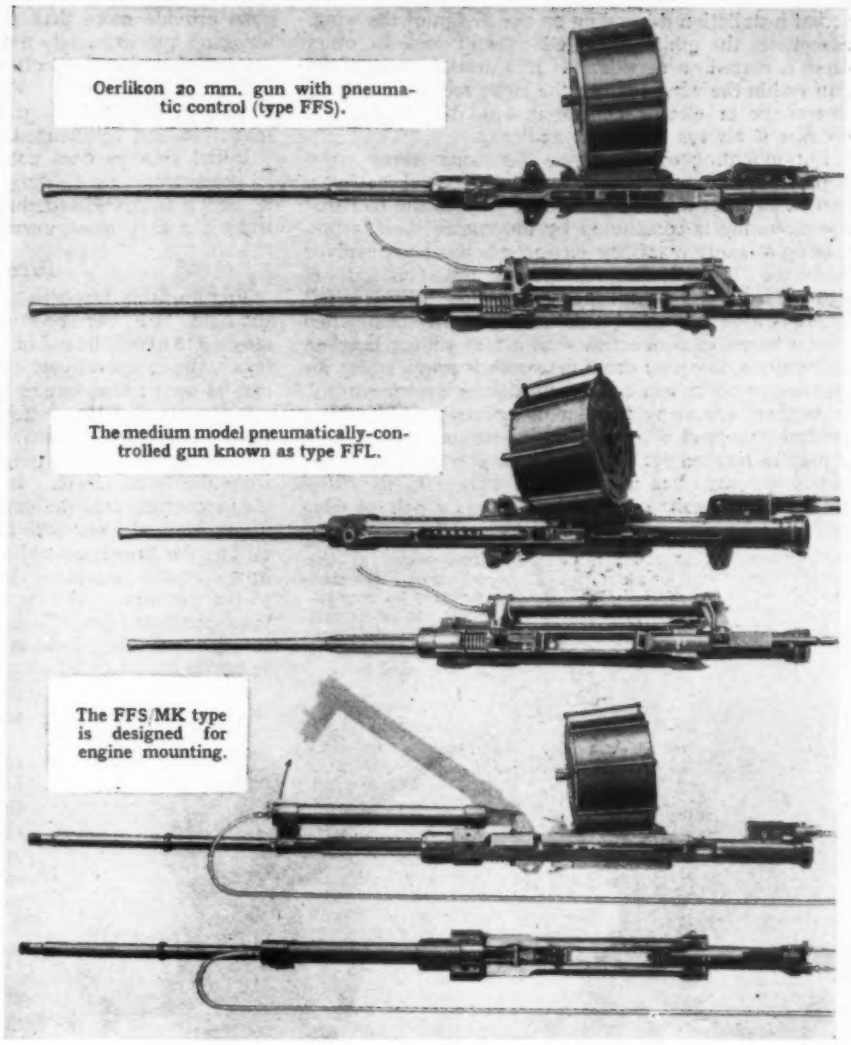
Medium model, Type "FFL," with 750 m/sec. initial velocity.

Heavy model, Type "FFS," with 830 m/sec. initial velocity.

Each of these guns can be used in any of the three methods mentioned, though in practice certain standards have been evolved which influence their application.

The type "FF" is particularly suitable for wing-mounting on fighters. This is easily understood on examining its specification and noting particularly its light weight. Actually the "FFL" which is rather heavier is also used as wing armament where special importance is attached to the higher initial velocity. Even the heavy type "FFS" can be used in the wings of comparatively large, heavy machines.

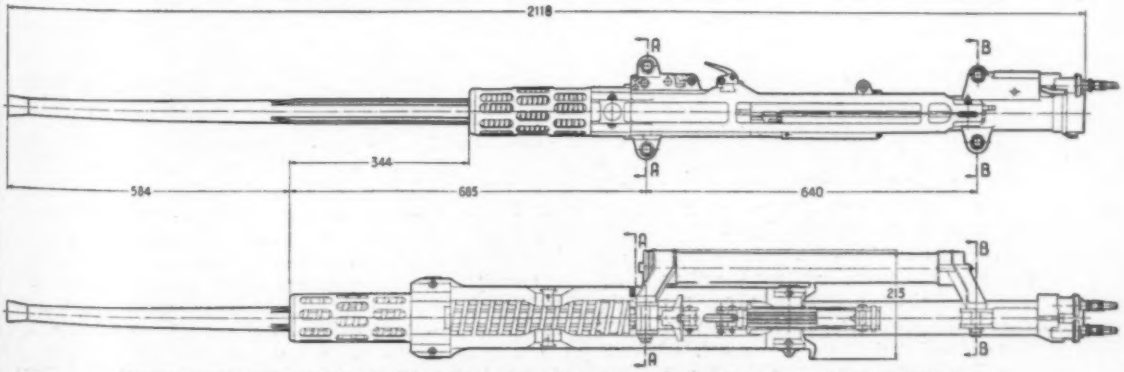
Wing guns are, of course, mounted in pairs, the



Oerlikon 20 mm. gun with pneumatic control (type FFS).

The medium model pneumatically-controlled gun known as type FFL.

The FFS/MK type is designed for engine mounting.



General arrangement of the Oerlikon FFS (pneumatic) type. The dimensions are given in millimetres.

actual installation depending on the design of the wing. Sometimes the gun is mounted upright and in other cases is placed on its side. If it is desired to keep the gun within the wing contour the latter method is better. Pneumatic or electric control is available though the cocking is always done pneumatically.

For mounting on an engine the requirements are a hollow airscrew hub through which the barrel may pass and small local modifications. In view of the fact that the mounting is constituted by the engine itself, representing a heavy mass, the engine gun has been evolved from the "FFS" weapon, with an initial velocity of 830 m/sec., and bears the designation "FFS/MK." There is a double-acting axial spring arrangement fitted to the barrel in connection with a rear sliding bearing. Generally a 60-round drum magazine is provided for the engine-gun which can have pneumatic or electric control.

As there are many popular misconceptions about the relative merits of wing and engine-mounted armament, it may be pointed out that the engine gun, with its higher initial velocity, has a certain advantage in its flatter trajectory, though, on the other hand, a pair of wing guns provide more than double the rate of fire while weighing approximately the same as one engine gun.

For rigid mounting in the fuselage, either the medium "FFL" or the heavy "FFS" guns may be used. In certain installations the guns are accessible, so that the magazines can be changed.

Initial velocity does not play such an essential part in present-day air fighting as is frequently ascribed to it, and it is considered that the velocity of the "FF" wing gun fully meets current requirements.

Free Guns

For movable mountings with a forward field of fire the light "FF" or the medium "FFL" gun should be selected to avoid the use of heavy or cumbersome mountings. On comparatively slow machines a simple swivel can be used for mounting a gun of the "FF" type, an appropriate shoulder rest being provided. The heavier type "FFL" can be used with a special trunnion mounting controlled through gears, the trigger being actuated from the hand wheel. In both cases the gunner has direct control, and the gun is provided with levers for single fire and automatic fire, and with a device maintaining the breech cocked after the last round has been fired. In the first place the breech is cocked by means of the pneumatic cocking device. The compressed air is supplied by a small flask holding three litres and fitted to the mounting within easy reach. In order to facilitate changing of magazines, drums of small capacity—20 to 30 rounds—are used as a general rule.

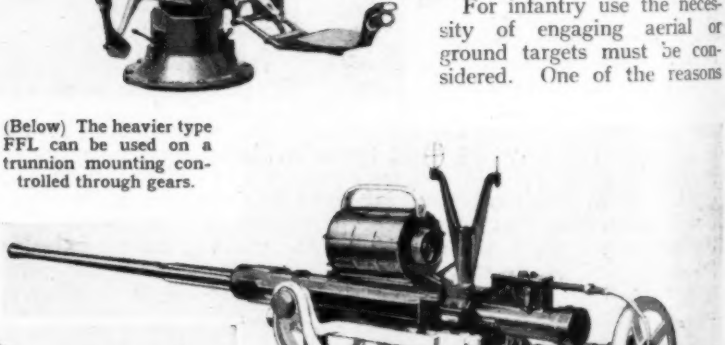
The only one of the guns considered suitable for a manually trained stern installation is the type "FF." To facilitate changing magazines, drums of 20 rounds capacity are normally used. Naturally, powered mountings would be very desirable, but no information on these is yet available.

For infantry use the necessity of engaging aerial or ground targets must be considered. One of the reasons put forward in favour of having two different weapons is that tanks can be fought most effectively by using a comparatively large shell. Since the weight of automatic weapons of adequate bore (37-47 mm.) prohibits their use by infantry, the automatic function is waived in favour of the greater effectiveness of the single shot.

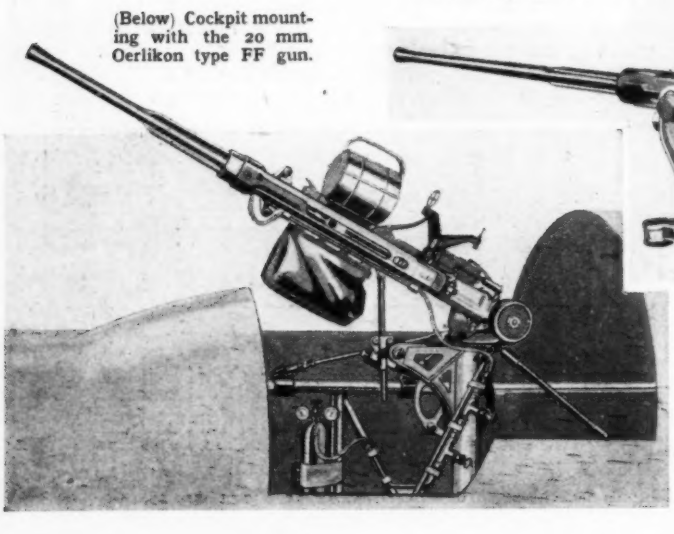
The 20 mm. Oerlikon type "JLaS" has

Two views of the 20 mm. Oerlikon designed for employment against aircraft and tanks. A fifteen-round magazine is used.

(Below) The heavier type FFL can be used on a trunnion mounting controlled through gears.

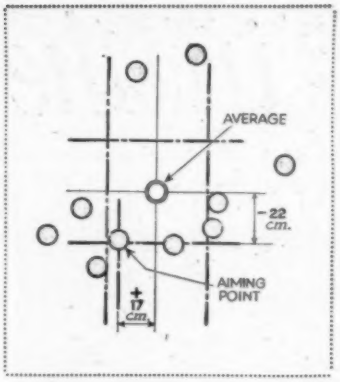


(Below) Cockpit mounting with the 20 mm. Oerlikon type FF gun.



largely contributed to the adoption of a weapon of "universal" application. This gun is quite effective against tanks, the automatic functioning being an important factor in its success against armour plate when compared with the single shot fired by a special anti-tank gun of larger bore, though this, singly, may be more effective.

The Oerlikon "JLaS" was designed to engage aircraft up to a height of 6,500ft. The weapon has a barrel length of 1,400 mm. and a muzzle velocity of about 830 m/sec. Fifteen-round magazines are used, and the firing rate is about 280 rounds a minute. Three different aiming devices are provided. There is the ordinary adjustable open sight fixed on the gun; the circular field telescope sight with lateral scale graduated in hectometres; and the anti-aircraft circular aperture sight connnected with the cradle by a control parallelogram, with automatic adjustment of the circle plane and automatic correction of the sight-carrier according to the sighting angle. The "JLa" mounting is composed of a cradle, upper mounting, lower mounting, axle bearer, three props and two wheels, and can be dismantled or assembled by a well-trained crew in about thirty seconds. The gun can be fired from wheels or on a tripod. If it is desired to use the gun as a stationary weapon as a protection for industrial plants or buildings, or to mount it on to motor lorries, armoured trains or ships, it can be bolted to a column mounting specially designed for the purpose.



Results of a test of the Oerlikon shell gun at a range of 1,000 metres. Note the aiming point and the "average" point of the ten shots.

All kinds of Oerlikon ammunition can be used, and the armour-piercing shell perforates hardened steel plates of 110-120 km. tensile strength (Brinell hardness 300-340) and of the following approximate thicknesses: 15 mm. up to 1,000 m.; 20 mm. up to 750 m.; 25 mm. up to 600 m.; 30 mm. up to 500 m.; 35 mm. up to 400 m.; and 40 mm. up to 300 m.

THE AIR WAR in POLAND

THE 650th Royal Aeronautical Society lecture was delivered at the Institute of Electrical Engineers, London, on April 19 by two Polish aeronautical engineers, Messrs. J. J. Dziewonski and S. Rogalski, who had been engaged on aircraft design right up to the outbreak of war in Poland. The authors stressed their realisation of the scarcity of actual data on which to base conclusions, and said that there is no doubt that a "Blitzkrieg" provides all of the experience to the winner, particularly if he enjoys an overwhelming superiority in the air and has secured a "total" victory.

Each of the Polish airframe and engine factories, some nine in all, was protected by two or four A.A. guns of 40 mm. Bofors or 75 mm. types, and a number of machine guns on the roof or nearby, manned by trained factory personnel. In the light of experience, such protection should be considered as inadequate, not only in equipment and power of fire, but in principle as well. It would not prevent a determined bombing force from doing its destructive work. Manning by factory personnel does not seem the best solution, as these neither have the necessary training and experience, nor can they be expected to perform their duties in the shops in emergency. For the protection of men during air raids, trenches were dug close outside the factory, and this also did not prove to be an efficient way of protecting the personnel.

Bombers made their first appearance at 7.30 a.m. on September 1. After that each bombardment was followed by observation planes taking photographs. The next morning only about 60 per cent. of the workers appeared, owing to disorganisation in transport and damage done to their dwellings. On September 3 nine bombs were dropped, three of which hit the main building, and the whole of the Warsaw aerodrome was heavily bombed. On September 4 P.Z.L. airframe factory practically ceased to exist after severe bombing by Ju 87 dive bombers.

The marksmanship of the German bombers in areas with protection was not very good, though improving quickly with experience. Some remarkably good marksmanship was, however, displayed on railways and trains, which was more like practice bombing. Dive bombing was much more effective even in protected areas. Observation of events at factories, however incomplete, allows some conclusions to be drawn.

First, it appears that an aero engine factory can be easily upset by comparatively little damage, owing to its complexity.

Second, local protection by artillery and machine guns will not be able either to ensure uninterrupted running of a plant, nor to prevent a determined enemy doing its destructive task. The balloon barrage, viewed from this point, is probably a still less effective protection.

It is inconceivable to have a war conducted with equipment manufactured and stored in peacetime. It is, therefore, necessary to have an industry capable of giving a greatly increased output in time of emergency. This means that plants should be capable of working smoothly under war conditions. They must be built underground, extensively subdivided and duplicated, or placed out of range of bombers.

The Polish Air Force consisted of 200 fighters (P11 and P7), 100 Los bombers, 180 Karas light bombers, 30 army co-operation machines. The majority of each class was destroyed on the ground, with a limited number lost in air action and by Polish A.A. fire. Servicing was made very difficult by incessant changes of landing fields. There were several occasions when emergency fields had to be abandoned after only one night in consequence of their discovery.

Dive Bombers

The number of German aircraft engaged is unknown, but it was near 2,000. The following machines were used:—

Bombers—Ju 52, Ju 86, He 111, Do 17, and Do 215.

Dive bombers—Ju 87 and Hs 123.

Fighters—He 112, Me 109, and Me 110.

Army co-operation—Hs 126 and Fieseler Storch.

German bombers usually appeared over protected areas above the range of the A.A. defences. When definite results had to be obtained, dive bombers were usually resorted to. Thus, both of the Warsaw P.Z.L. factories were destroyed by Ju 87 dive bombers, which were also extensively used for bombing of Lwow. Besides the Ju 87, the Henschel Hs 123 dive bombers were used to attack the fortifications on the Hel peninsula, and in Modlin near Warsaw. To deceive the A.A. batteries, the following tactics were used: A formation of five aircraft, of which two were dive bombers, flew over the object at an altitude near the ceiling of the batteries. Then the dive bombers suddenly broke off formation, and it seemed as though these were hit. The batteries concentrated their fire on the level flying craft, thus enabling the dive bombers to do their work. The Ju 87 and Hs 123 can be credited with a high degree of manœuvrability.

The Germans struck at airports and landing fields on the first morning by surprise attacks from low altitude with explosive and incendiary bombs and machine guns. Vital industrial plants were raided and empty roads bombed, destroying also the telephone wires alongside. It was a powerful attack on the whole country.

The P11 fighters should be considered obsolete, but it is astonishing that they were able to shoot down a number of German bombers and even fighters of the Me 109 class when encountering the German machines under favourable circumstances, enabling them to gain speed through a dive. The success of these fighters is due to their high manœuvrability. The number of machines lost by the Luftwaffe through A.A. fire is probably about 200, about 250 being claimed as shot down by the Polish Air Force.

WAR in the AIR

Bombing and yet more Bombing : British Fighters in Norway : Air Minister's Broadcast

WHAT DID THEY SCRATCH OUT? This picture of Ju 87 dive-bombers in Norway has apparently been "doctored" by the German censors. It will be seen that the under surfaces of the wings have been obliterated. In the foreground are 250-kg. bombs and behind the "87s" a Ju 52 transport without its undercarriage.

EVERYBODY applauded the spirit with which the R.A.F. hammered away at the aerodrome at Stavanger and also made the lives of Germans at Aalborg miserable and precarious, but for some time wonder was growing as to why the aerodromes round Oslo were left undisturbed. The Germans have made the Norwegian capital their chief military base, and they have naturally used the two aerodromes there for a concentration of aircraft to work with their Army. It seems that they must have swept away at least part of the minefield which was laid along the Baltic coasts of Germany and have been able to get sea transports through to Oslo. An air base in a foreign country needs a tremendous amount of ground impedimenta, including numbers of heavy lorries which cannot be transported by air, and these must have been coming in by sea to Oslo. Whether Stavanger has been supplied by ground transport from Oslo cannot be said with certainty, but there is every probability that there must be a great concentration of necessary aircraft stores and facilities for repairs at Oslo.

However, on the night of Monday-Tuesday, April 22-23, the Bomber Command at last turned its serious attention to the Oslo aerodromes; Fornebu, which is a new civil aerodrome to the west of the city, and Kjeller. The raids were made in the early hours of the Tuesday morning. Fornebu was covered with snow. H.E. and incendiary bombs were dropped on both aerodromes, and a large fire was left blazing opposite the hangar buildings at Fornebu.

At the same time another bomber force visited Aalborg again, for the third night in succession. The anti-aircraft fire was heavier than before, and the guns had evidently been reinforced. Our men disregarded this and pressed their attacks home with characteristic determination. One of our machines was hit between the fuselage and one engine nacelle by a small calibre shell, but was able to complete its attack and get safely home. We lost one machine during the night's operations.

The following night, April 23-24, saw the most extensive series of operations yet undertaken by the Bomber Command. In Norway there were raids on Fornebu again, on Stavanger for the fifteenth time, and on Kristiansand; Aalborg received its fourth consecutive visit; Westerland aerodrome on the island of Sylt, was bombed for the first time, while another force carried out an offensive patrol off the Frisian Islands, and in the course of it bombed and sank two auxiliary patrol vessels. It was a most energetic night's work.

The bombers which went to Fornebu dropped heavy bombs on the landing ground. Of course, if time is given, holes in an aerodrome can be filled in, but that can hardly be done satisfactorily if the bombing goes on continuously. A sound maxim of bombing is "when you have cut a line of communication, keep it cut." One of the bombers bound for Oslo sighted two enemy ships steaming northwards in Oslo Fjord; it turned off to attack them, and dropped a salvo near the leading ship. The latter made

—WAS IT THIS? A Ju 87 dive-bomber fitted with what appear to be long-range fuel tanks which are attached to the wing bomb racks. Normally these outboard racks accommodate four 50-kg. bombs.

for the shore, and our pilot then came down to 150 feet and turned his machine guns on to the decks and superstructure.

At Stavanger that night our raiders found some twenty German aircraft dispersed round the sides of the aerodrome, and the pilots felt confident that they had played havoc with quite a number of them. It is reported that several Messerschmitt 110 fighters tried to dispute matters with our bombers, who have not as a rule found German fighters in the air at nights. One Me 110 is said to have followed one of our bombers for ten minutes as it retreated after carrying out its attack, but of all the numerous machines which we had out that night only two failed to return.

Later reports of this raid confirm the extensive damage done to the air base. They also show that a number of enemy aircraft dispersed on the ground flamed up after a salvo of high explosive bombs, dropped from a low level, had burst close by. Fierce fires started by incendiary bombs were seen to be still blazing after the last of the British raiders had left the scene.

At Westerland, in Sylt, our bombers found night operations in progress, for lights were showing in the hangars and round the boundary of the aerodrome. They went out as the Germans heard the sound of the British engines. Obviously our attack came as a surprise, and the first of our machines to drop its bombs met only moderate fire. Presently the German gunners woke up and got to their stations, and then the defence became quite energetic. But how many tons of shells, we should like to ask, does it take to bring down one British bomber?

Further details of the raid on Westerland have been made available by two of the pilots who took part in it. One of them said: "We were attacking singly. I was flying round over Sylt for 40 minutes before I attacked the aerodrome, which was not easy to find, for though there was a moon it was hidden by the clouds. Several times we got caught by a group of about 5 or 6 searchlights. The gun fire was not so accurate, though there was a good deal of it. They gave us pom-poms with tracers, the usual 'flaming onions' and the ordinary heavy stuff, but none of them came anywhere near us." While the searchlights were concentrating on this single aircraft, another of our bombers came over the target. The pilot of this aircraft said: "We believe that some at least of our bombs dropped pretty well at the point where the runways intersect. Up to this time we had not drawn very much fire, but they gave it to us more heavily after we had made our attack. Later, on the way back and when we thought we had got out of the danger zone, one of the F.L.A.K. ships let go a couple at us."

This raid on Westerland had a sequel, for the Germans accused us of a breach of the laws of war. Westerland, they said, was a well-known health resort. So it may have been before the war, but it is well known that all civilians were evacuated from Sylt a considerable time ago. They went on to accuse us of bombing the "undefended" town of Heide, in Schleswig-Holstein. The Air Ministry promptly denied that we had done so.

While these raids were in progress, other aircraft of the Bomber Command were carrying out their customary security patrol over the bases of German mine-laying aircraft. One of these aircraft patrolling off the island of Sylt was fired on by two naval auxiliaries. Selecting its target and diving from 4,000 to 1,500 feet in the face of intense A.A. fire, the British aircraft bombed one of the ships. The A.A. fire ceased abruptly, and to quote the words of the pilot's own report "the ship disappeared." Another aircraft, patrolling a nearby area soon after midnight, came under fire from two large motor boats. The aircraft at once made a low level bombing attack dropping six bombs in quick succession, and, on turning back to observe the results, the pilot could see only one boat on the water. This aircraft was also able to observe the attack on Westerland from a distance and reported seeing a large explosion on the west side of the aerodrome.

This particular attention paid to Sylt may be taken as a consequence of some liveliness which had occurred off our East and South East coasts on the night of Monday, April 22. A number of enemy aircraft had appeared off our coasts, and were supposed to be trying to lay mines in the Thames and Humber estuaries. Anti-aircraft batteries and naval units opened fire at several points, searchlights were exposed, and fighters went up to try to intercept. So far as is known, no mines were found as a result of this little incident. Next night, as told above, Sylt had something else to think about, and that something happened just when the German airmen were getting busy.

A Coastal Command Hudson lately came home with both wings pierced by A.A. shells and the fuselage spattered with shrapnel. A petrol tank was holed and the machine was brought back on one engine. One tyre had been punctured.

On Wednesday, April 24, it was the turn of Scapa Flow, and numerous enemy aircraft tried a bombing attack there late at night. Two bombs were seen to fall on heather moors, and one German pilot made an abortive attack on an open road. No damage or casualties were caused to us, and the raiders were driven off by heavy gun-fire and by fighters of the R.A.F. We should also like to ask how many tons of bombs it takes to score even a grazing hit on a British warship?

The Royal Air Force dealt still another fierce blow at Germany's efforts to dominate the fjords near to Bergen, during an action early on Thursday afternoon, April 25. It was known that German supply ships were already "safe" in Hardanger and Granvin fjords, which penetrate some fifty miles east of Bergen, and that enemy bases had been established in small ports near to the entrances. The enemy's busy preparations had been carefully reported on until the moment came for striking. Soon after midday the first section of our raiding force of Bristol Blenheim bombers swept across the channel into the narrow Granvin fjord, and found their first target—a transport vessel, with its hatches open. One heavy bomb exploded within ten yards of the starboard bows. The aircraft then sought out the quayside at Granvin, the adjoining fjord, and dropped a salvo of bombs from 2,000 ft. Direct hits on the quay, so necessary to the German landing plans, were registered. The second section of bombers made for the little port of Ulvik, set at the head of the next fjord. Here they found a 2,000-ton supply ship and a military encampment recently pitched on the foreshore. Two of the air-

craft reported that after the bombing attack the supply ship was lying on its side, already partly submerged. The attack on the encampment was also successful.

A Dornier 18 flying boat fell to one of the British bombers after it had set its course for home. The Blenheim sighted two Dorniers, one flying about 500 feet and the other about 1,000 feet above the water. The British pilot turned to intercept, just as the nearest Dornier alighted on the fjord. While the Blenheim opened fire the second Dornier dived to the help of its companion. Tracer bullets from both front and rear guns of the Blenheim made a merciless attack on the hull of the flying boat. With the rear gunner of the floating Dornier returning fire and the second enemy now within range and opening fire with its rear guns, the Blenheim turned sharply to starboard and brought its rear gunner into action. The battle was quick and violent and the Dornier, diving clear, turned and attacked the Briton head on. The flying boat then altered course and the two aircraft passed within ten yards of one another less than one hundred feet above the fjord. The Blenheim used its guns to good purpose then, and a burst was fired into the Dornier at point blank range. A cloud of black smoke streamed from its engines as it nosed steeply over and plunged into the water. The Blenheim then faced the fire of the surviving Dornier from the sea. The pilot did not give up until he was wounded in the face and right hand. Only then did he make for the British coast, with one satisfying last view of the first Dornier almost submerged in the waters of the fjord.

Thursday night saw raids on other German bases, too. Stavanger was bombed and so were places up Oslo fjord. In the latter ten large supply ships were seen and bombed. Opposition was encountered from ships and coastal batteries, and though the full results of the bombing could not be observed because of bad visibility, a direct hit is believed to have been registered on a 5,000-ton supply ship. Others may have been badly damaged. Higher up the fjord oil tanks and a refinery plant at Vallo were subjected to three separate attacks, each lasting for about 20 minutes. Incendiary bombs covered most of the target area, and the refinery building itself was set on fire by a direct hit. Oil tanks on each side of the building were also seen to be in flames and, to quote one of the pilots: "The whole place was well alight when the last of our aircraft left."

One of the pilots from Oslo, flying home some hours after the raid on Stavanger, saw a large fire burning strongly on or near the air base there. The raiders of Stavanger had bombed four supply ships of about 4,500 tons with incendiary bombs, and had raked the decks with machine gun fire.

Anti-Aircraft Bombing

NEXT day, Friday, April 26, there was another fight between a Blenheim and two German flying boats. It took place in the morning and lasted for twenty minutes. The Blenheim was on reconnaissance far out over the North Sea when two twin-engined German flying boats were seen flying in echelon formation 100 yards apart and only 50 feet above the water. Manœuvring into position astern of the formation, the Blenheim singled out the right-hand flying boat and attacked it with two heavy bombs. These were seen to overshoot as both flying boats, breaking formation, took violent evasive action. Waiting until the enemy aircraft had resumed formation, the British bomber renewed its attack, this time closing to within short range and opening fire with the front gun on both enemy aircraft in turn. Pressing home his attack in the face of heavy fire from the rear gunners of both flying boats, the British pilot saw his tracer bullets repeatedly enter the nacelle housing the twin engines of the nearest flying boat. Turning on the other, the Blenheim pilot made a second bombing attack and, after seeing his bomb again overshoot, turned sharply away from the target to bring his rear gunner into action. A moment later the enemy, whose engines had been hit earlier, was seen to be in difficulties and, with smoke pouring from his nacelle, broke away and made off towards the German coast followed closely by his companion. The Blenheim resumed its reconnaissance.

In the two days, April 25 and 26, five of our aircraft failed to return.

The military position in Norway is still obscure. Admittedly the Germans have the advantage for the time in the air, and they have been using their aircraft to harass our Expeditionary Force. The roads and railways assisting the British forces have been heavily bombed by the German air force, but reports indicate that communication has only been moderately cut and that repairs can be done fairly quickly. Another report says that parachute troops have been used at the Otta railway station, in Gudbrandsdal, south of Dombaas, where a previous attack by German parachute troops failed completely. Eight of the new lot got into difficulties as they landed, becoming involved with a telephone wire, and were captured right away. Twenty-six more have since been taken prisoner, and Norwegian ski troops set off in pursuit of the rest. Many of the reports come from Sweden, and are not to be taken without reserve. One of them says that German aircraft have been seen flying towards Narvik, presumably with supplies if not reinforcements, but where they would land so as to get the stuff to the German troops there does not appear. There is no aerodrome nearer to Narvik than 50 miles away.

British Fighters Arrive

TOWARDS the end of last week it was announced that anti-aircraft guns and fighter aircraft had been landed by the British in Norway. The fighters had to use a frozen lake as an aerodrome. They were promptly attacked by German bombers and some of our machines were damaged, but none the less they were able to establish a base. Results soon followed, for on last Friday it was announced that six enemy aircraft had been shot down and eight others damaged by our fighters and A.A. guns in Norway. Since then the German air attacks on our troops have appreciably diminished in intensity.

A cheerful story is told about some Norwegian airmen. Overhearing German airmen in a beerhouse adjoining a Norwegian fjord saying where their Heinkel seaplane was moored, two Norwegian airmen procured some paint, reached the seaplane, obliterated the swastikas, and painted in the Norwegian colours. They then flew the seaplane to a British port. Three Norwegian airmen had previously reached the same port with a Norwegian aeroplane in which they had escaped when their country was first invaded.

Meanwhile the French *Armée de l'Air* has been doing some long-range reconnaissance over Germany. A French communiqué has stated that "During the night of April 22-23 our aircraft made many long-distance reconnaissances, penetrating to many hundreds of kilometres over enemy territory. They flew over the Prague region."

Sir Samuel Hoare, Air Minister, gave a broadcast address on last Saturday evening, and we extract the following passages:—"The war," he said, "has entered an intense and vital phase. The enemy will wage it without mercy. He will give us no quarter. For our part we will not imitate his dastardly conduct. We will not let helpless seamen drown. We will not bomb open towns. We will not attempt to defeat the Germans by terrorising their women and children. All that we will leave to the enemy. But we will not leave him any monopoly of energy and skill and resolution. We must show those qualities to a degree far excelling the determination and ingenuity that he displays. Nor shall we pay the least attention to any threats that he may make." After paying a tribute to the deeds of the R.A.F. in the Norway campaign, Sir Samuel said that we must be ready to help the Air Force to succeed. We must recognise the need to mobilise the whole of our air strength. We could have no half measures. We dared not leave any resource untapped. The men and women of the aircraft industry must go all out to supply the machines and engines and equipment in ever-growing numbers; and the employers of labour must bring all their drive and experience into this national effort. The Government must never waver in its resolve to win and hold the mastery of the skies as well as of the seas

"Flight" photograph

IMPROVED SINGLE-ENGINE PERFORMANCE. The De Havilland D.H.95 has now been fitted with fully-feathering airscrews. It is here seen flying with one Perseus XVI engine stopped and the airscrew turned "edge on."

HERE and THERE

Rolls-Royce Dividends

ROLLS-ROYCE, LTD., announce the payment of an interim dividend for 1939 of 5 per cent. Payment will be made on June 15 next.

An Alvis Anniversary

ON April 25 Alvis, Ltd., celebrated the 21st birthday of the company at a smoking concert in Coventry. An illuminated address was presented to Mr. T. G. John, founder, chairman and managing director of the Alvis company.

Vickers Appointments

VICKERS, LIMITED, announce that, as a result of his appointment to the post of Civil Member of the Air Council (announced in *Flight* last week), Sir Charles Craven has been granted leave of absence from the Vickers group of companies, and Mr. F. C. Yapp becomes acting chairman of Vickers-Armstrongs, Ltd., and of the English Steel Corporation. Mr. J. Callander becomes acting deputy chairman of Vickers-Armstrongs.

Air Scheme in Rhodesia

MR. R. C. TREDGOLD, Minister of Defence in Southern Rhodesia, outlined Rhodesia's contribution to the war effort, and said it had been estimated that by March, 1941, an air scheme will be in operation which will involve personnel of about 3,000.

The scheme has been evolved in co-operation with the R.A.F. and the Colony had offered the personnel for three squadrons. The schools established there will provide training for Rhodesian personnel, and also for personnel from other parts of the Empire.

"The arrangement with regard to cost and staffing is on the co-operative basis between the R.A.F. and ourselves. The main cost will be found by the Imperial Government, and a large number of the personnel by the R.A.F.; but Southern Rhodesia will contribute as regards cost and personnel to the limit in its power. Our own headquarters staff will remain intact and control the whole scheme. . . . It was easy with an extensive air scheme for the country to over-estimate the relative importance of air to ground troops. There was a tendency to regard the latter as of secondary importance. The war was one that he believed would not be won in the air or on the ground alone, but by the nation that made the best use of its personnel and material both on the ground and in the air."

Referring to the troops and to the men who would serve with the Air Force, Mr. Tredgold said it had been decided that the units should not serve as units of the Southern Rhodesia Forces, but that they should be entirely assimilated into the units with which they served. They would, however, be retained in sub-units and kept together, and wear distinctive badges indicating that they came from Rhodesia. He strongly emphasised that it was still accepted that their primary responsibility lay in Africa. They must secure themselves in the first place, and, secondly, they must be ready to assist their neighbours in Africa if aid was required.

1939 Manly Medal

TWO Englishmen were awarded the Manly Medal *in absentia* at the National Aeronautic Meeting banquet—Ernest Walter Hives and Frederick Llewellyn Smith, general works manager and assistant works manager, respectively, of Rolls-Royce, Ltd. Their paper, "High-Output Aircraft Engines," was rated at the top of those presented before the S.A.E. in 1939 "relating to theory or practice in the design or construction of, or research on, aeronautic power plants or their parts or accessories."

In the absence of the authors, S. D. Heron, chairman of the board of award, made the presentation to Maurice Olley, also of Rolls-Royce, Ltd.

Mr. Hives has been associated with Rolls-Royce for the last 32 years. From 1915 to 1936 he was in charge of the Experimental Department and was responsible for the development of both Rolls-Royce motor cars and aircraft engines. His appointment to his present position as general works manager came in October, 1936. Shortly thereafter he became a director of the company. Mr. Hives controls the Rolls-Royce factories at Derby and Crewe and is deputy controller of the Air Ministry-owned factory manufacturing Rolls-Royce aircraft engines at Glasgow. He also serves as a director for Rotol, Ltd.

Dr. Smith is a graduate at the Universities of Manchester and Oxford. His rise in Rolls-Royce has been rapid: experimental engineer in 1933; technical assistant to the general works manager of the Crewe factory in February, 1940.

COMMERCIAL AVIATION

THE SEATS OF THE MIGHTY. The pilots' cockpit of the first Boeing 307, now known by Pan American Airways as the Stratoclipper class. The design of windscreen is rather puzzling, as each panel appears to be divided into four. The dividing lines might possibly be reinforcement to strengthen the transparent panels against the internal pressure. The two extra struts in the middle may be part of the instrument board structure. The three sun visors should be noted.

THE HIGH AIRS

"A. Viator" on the Right to Stop and Search Air Liners

I HEAR that the various K.L.M. machines which were in Scandinavia when the bit of international botheration started there have now returned to Holland, and that the Swedish Air Lines machine which made Amsterdam its terminus for the time being has now flown on home to Stockholm. There seems to be some prospect of services reopening between some Scandinavian countries and Holland fairly shortly, but what routes will be followed and whether a stop will be made in Copenhagen is not yet known.

Things are not made much easier on the air routes by all this warfare, and neutral pilots have some quaint experiences, especially on the route towards Holland and Scandinavia. They may meet military planes of both belligerents in the course of a journey, and being bright orange-coloured neutrals they will bow politely to both parties and wish them, in passing, a very good morning.

What the neutral commander tries to avoid is anything in the nature of a gregarious gathering in which both parties meet one another in his vicinity, and his theme song is apt to be, "How happy could I be with either, were t'other great blighter away." In fact he prefers, being a peaceful kind of a bloke, a small gin and bitters after landing to a large din and jitters on the way across.

A certain amount of newspaper comment has been caused lately by the announcement of M. Monnet, French Blockade Minister, that neutral air lines to Lisbon afforded facilities to the enemy for breaking the blockade.

One chirrupy columnist linked up the K.L.M. Amsterdam-Lisbon service with this matter, and it is therefore interesting to examine the probability, or rather the improbability, of the enemy making much use of this service.

It is true that it is a direct flight from one neutral country to another, which remains outside French and British territorial waters all the way. Thus it is an absolutely neutral service, and in Amsterdam or Lisbon a Frenchman or a Briton may book a passage on this route, and so, of course, may a German. The question is whether a German would so so, however, because this flight is made along the English Channel and around the French coast, and consequently it is under Allied supervision the whole way.

The columnist remarked that the right to stop and search the air liner in the high airs existed in the same way as the right to stop and search a merchant vessel on the high seas. Probably this is so, for in many respects air history and tradition is being made to-day.

Passing lightly over the minor point that the expression "The High Airs" was coined in *Flight*, I come to the fact that if the aircraft on the Amsterdam-Lisbon line are liable to be called into port for contraband control at any moment, no intelligent German is likely to make use of this service.

This is especially obvious when one considers that there is a regular "covered way," if one may use the term in connection with air transport, from Berlin via Rome to Barcelona and thence to Portugal. That route is all under German, Italian or Spanish control.

One of the most intelligent of our air correspondents wrote on this subject as follows: "If M. Monnet wants to control air contraband and currency flowing between Germany and America, he should do so by having the Italian air liners in the Mediterranean called into Marseilles for contraband control just as is done with ships"; which would be a pretty kettle of fish, maybe, and one liable to boil over at any moment with considerable spluttering and steam, but with no further result, one supposes.

Converted Bombers

Somebody has suggested that our lack of commercial aircraft after the war can be remedied by the use of the converted bomber. We tried the same thing after the last war, without much success, but we then had the excuse that commercial aircraft had not yet come into being to any extent worth mentioning.

This time our excuses will be many and varied, but they will be mere empty verbiage, for everybody, except the Powers that Be, realises the position now, and knows that provision could and should be made for post-war commercial air expansion.

But this bomber racket might be worth trying in default of a better. Bomb racks might be beaten into luggage racks and gun turrets might be converted into small smoking compartments of the conservatory type where, in company with an aspidistra and a hanging basket of fragrant Stinkbine, the wealthier type of client might meditate, over a rich cigar, on the profits to be derived from beating a quite good sword into an indifferent ploughshare.

As for the converted bomber pilot, I am not so sure, for we have seen all that in the past. Military pilots not only have to learn to fly civil machines in a civil manner, from the passengers' point of view, but they have to unlearn a lot of military stuff which is useless and even harmful to a commercial organisation.

To take off in a steep climbing turn may amuse a bomber crew, but it is liable to shift the personal centre of gravity of the average passenger from his solar plexus to the tips of his toes. To approach playfully an airport in the manner of one practising power dives not only makes a passenger's heart sink to his boots but convinces him that his boots have rushed up and kicked him under the chin.

The absent-minded distribution of a load of daily newspapers, leaflet fashion, over a city, might save road transport costs, and so might the casual pressure of button B, which released the assorted baggage of twenty passengers from the converted bomb racks.

A. VIATOR.

Accident in Scotland

ON a flight from Perth to Heston without passengers on April 23, a Lockheed 14 belonging to British Overseas Airways crashed into Beinn Uird, near Loch Lomond, and caused the death of the pilot, Captain D. S. King, and the crew, First Officer D. E. Eveleigh and Radio Officer J. W. Elliott. The wreckage, which was found 300ft. below the summit of the 2,000ft. mountain, was not burnt out. At the time of the accident the cloud base was very low in the surrounding district.

No Atlantic Service

IT has been announced in the House of Commons by Capt. Balfour, Under-Secretary for Air, that there will be no British service across the North Atlantic this year as the flying boats, *Caribou* and *Cabot*, are still required for the military work on which they have been engaged for some time.

The service to Lisbon, for which survey flights are now being made by British Overseas Airways, will be established from Gatwick in the near future and will link with Pan American Clipper. Letters by air for the United States, Canada and Newfoundland should be marked "North Atlantic Air Service" and have the blue airmail label. The letter rate is 1s. 3d. per ½oz. and 7d. for postcards.

British Overseas Airways News

A NEW Empire boat has been delivered to the Corporation and has been named *Clifton*. This is only the second new flying boat or aeroplane which has been added to their fleet since war, while depletions due to military acquisition and accidents have made great inroads on the equipment available for maintaining the services. Since the *Hannibal* accident, all these magnificent old Handley Page 42s have been grounded. If this is the end of their flying life, it is an unfortunate end, for they deserved, after their wonderful record of safe flying to be honourably "pensioned off," not, as it were, "court-martialled."

Corsair, the boat which was salvaged out of the heart of Africa after a dam had been built on a narrow stream to bank up sufficient water for the take-off, is back again in service and has completed its first run to Australia and return without incident. Captain Shakespeare flew her back.

The landplane organisation will move to Gatwick about the middle of May and the Lisbon service will officially start as soon as the shift is accomplished. Three preliminary flights have been made and a fourth is now being flown. De Havilland Frobishers have been used on all of them.

Tasman Service Starts

THE trans-Tasman service started on Tuesday, April 30, with the first scheduled flight between Sydney and Auckland. One return trip per week will be flown using the two flying boats *Aotearoa* and *Awarua*. The Auckland to Sydney flights will be made on Thursdays.

Postal Services

THE Postmaster General announces the restoration of the letter mail (including air mails) and the money order services to Sweden, Estonia, Latvia and Lithuania, but the correspondence is subject to delay.

The latest time of posting at the Head Post Office, London, E.C.1, for air mail to Malta (1s. 3d. per half ounce and postcards 7d.) is now midnight on Thursdays only.

Whitsun Travel to Jersey

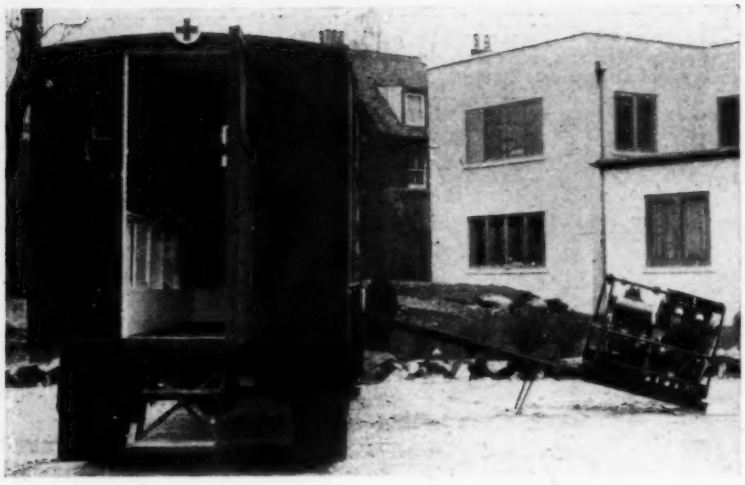
JERSEY AIRWAYS announce special time-tables for Whitsun, operating between May 9 and 15. Passengers for Jersey or Guernsey should present themselves at Shoreham Airport not later than 7.30, 10.00 or 12.15 on any of the above days. There are other departures for Jersey at 14.15 hours on each of the seven days and at 16.15 and 18.15 on Friday, Saturday and Monday. Additional Guernsey departures are at 16.15 on Friday, Saturday and Monday. The returns from Jersey occur at the same times that have already been given for the departures to Jersey. Departures from Guernsey are at 10.15 and 14.30 each day with an extra trip leaving at 18.30 on Friday, Saturday and Monday.

New Service to Brussels

FROM May 1 Sabena will operate an additional service from Shoreham to Brussels on each week-day. The new time-table from that date will be:—

Daily	*Weekdays*		*Weekdays*	*Daily*
8.45	17.30	Dep. Shoreham Airport, Arr.	10.30	17.00
10.15	19.00	Arr. Brussels Airport, Dep.	9.00	15.30

Passengers will still be required to arrive at the airport 75 to 90 minutes before departure, and those leaving on the afternoon plane can take the 2.28 train from Victoria, arriving at Shoreham-by-Sea at 4.04. In the case of the early morning service it will be advisable to travel overnight to Brighton, where special terms are available for passengers at the Grand Hotel (8s. 6d. for a single room and breakfast). Fares remain unchanged at £7 10s. single and £13 10s. return, including the coach to the town terminus in Brussels but not the journey to Shoreham Airport.



The travelling X-Ray theatre produced in Lagonda body building shops.

First Aid X-Ray

Lagonda Motors, Ltd., in addition to being very fully occupied with work on important aircraft and other engineering contracts, have turned their very well equipped body shops over to the manufacture of mobile X-ray theatres for service with the Forces.

X-rays offer the only satisfactory means of ascertaining the nature and extent of fractures and the exact location of metal fragments embedded in the tissues. These two types of injury are of frequent occurrence in action and the most important factor in minimising their ill-effects in swift surgical operation.

Each laboratory contains a portable X-ray unit which can be quickly erected close alongside. The electricity supply necessary to energise the high tension transformer of the X-ray unit is generated by a petrol-electric set, made by Petter's of Loughborough, conveniently mounted in the forward part of the body. This feeds the X-ray set via a rotary convertor having an output of 65v. A.C.

On the vehicle reaching the scene of its activities, the generating unit is run down a ramp and placed in such a position as to preclude any possibility of interference with the actual X-ray part of the vehicle while it is generating the required power and light. It is then the work of minutes to position and expose the X-ray film, which is then developed. A number of films can be dealt with simultaneously, the laboratory being fitted with tanks for developing, fixing and washing, and racks for accommodating the films whilst they are drying. The benches are illuminated by special X-ray safe-lights and lanterns are provided for viewing the finished X-ray films.

Perkins Diesels

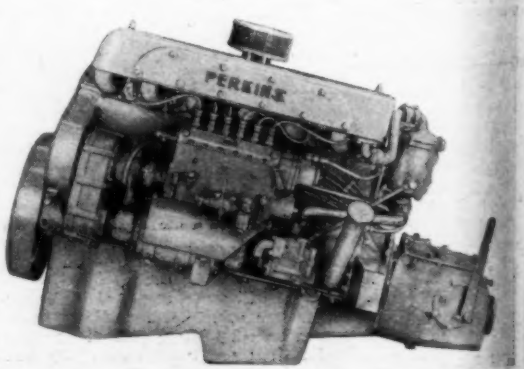
THE war in the air, involving as it does many hours of flying over the sea, establishes a definite need for high speed salvaging and servicing surface craft of undoubted reliability. Since speed is one of the chief essentials in much of the work performed, the development of power boats of many types has received considerable attention. As a power unit the diesel fits in well with these requirements, and one of the firms who have specialised in its development for this type of work is F. Perkins, Ltd., of Peterborough.

Compression ignition engines produced by this firm are the result of many years of experience in the building of such power units for Government Marine Departments and leading builders of high speed boats. Light weight and excellent accessibility are among the main feature, and the extensive use of jigs for the various parts makes it possible for the makers to guarantee interchangeability. Careful inspection of components before building and strict, accurate testing afterwards ensure that every engine leaves the works in first-class trim.

Two types are in production. Type P6M has six cylinders of 3½in. bore and 5in stroke, and S6M has six cylinders of 4⅜in. bore and 5in. stroke. The rating of P6M is 65 b.h.p. at 2,250 r.p.m. continuous rating with an overload capacity of 80 b.h.p. at 2,500 r.p.m. for periods not exceeding two hours. In the case of S6M the engine is rated at 100 b.h.p. at 2,000 r.p.m. continuous rating with an overload capacity of 130 b.h.p. at 2,250 r.p.m. for periods not exceeding two hours.

The following figures are interesting since they were produced during routine test conditions under independent observation; they apply to type S6M. At 1,000 r.p.m., 60 h.p.; 1,500 r.p.m., 92 h.p.; 2,000 r.p.m., 121 h.p.; 2,250 r.p.m., 131.5 h.p. All tests were carried out with the engine at the angle of installation and it was noticed that at no speed was there any appreciable vibration and nothing in the nature of a period.

Boats of from approximately 20ft. to 60ft. are utilising these engines which, according to requirements, are installed singly or in pairs or threes.



The Perkins S6M 100 h.p. diesel engine.

THE INDUSTRY

NEW COMPANIES

K.R.G. AIRCRAFT CO., LTD.—Private company. Registered April 16. Capital £5,000 in 5,000 shares of £1 each. Objects: To carry on business as manufacturers of and dealers in new and second-hand aeroplanes, seaplanes, hydroplanes, flying boats, etc. The permanent directors are: Hargreaves Bateson, 9, Park Drive, Blackpool; Deane Bateson, 184, Reads Avenue, Blackpool; Miss Isabella Bateson, "Renson Deane," St. Ives Avenue, Blackpool; and John Windle, 362, Clifton Drive North, St. Annes-on-the-Sea, Lancs. Solicitor: Vincent Wareing, 32, Talbot Road, Blackpool.

SOUTHERN AIRCRAFT (CLAPHAM), LTD.—Private company. Registered April 20. Capital £100 in 100 shares of £1 each. Objects: To carry on business as aeronautical engineers and consultants; manufacturers of and dealers in aircraft of all kinds and all components, fittings and accessories, etc. The permanent directors are: John E. Coxon, "Glenalmond," Massetts Road, Horley, Surrey, and Norman May, 72, Park Hill, Clapham, S.W.4.

HERTS AND ESSEX AVIATION, LTD.—Private company. Registered April 18. Capital £100 in 100 shares of £1 each. Objects: To carry on the business of manufacturers of aircraft, engines and aircraft components, hirers and charterers of aircraft, instructors in flying, aerial navigation, etc. The permanent directors are: Arthur R. Frogley, Manor Farm, Broxbourne, Herts, aeronautical engineer (director of Herts and Essex Aero Club, Ltd., and Grimsby Aviation, Ltd.), and Hetty M. Frogley, Manor Farm, Broxbourne, Herts. Arthur R. Frogley is chairman. Secretary: Henry E. Puttock. Registered office: 329, High Holborn, W.C.1.

ANSWERS

Below we give the answers to the Test Questions on page b.

1. A Westland Wallace and a Westland P.V.3.
2. The Spitfire (eight machine-guns). The Wellington has six guns.
3. The Hon. C. S. Rolls on June 2, 1910.
4. Hydromatic.
5. The absence of bracing wires.
6. Tachometer.
7. It has *not* disappeared. The Supermarine Walrus is still in service.
8. 19½ days.
9. At Monaco, on April 16, 1913.
10. Curtiss-Wright CW-20.
11. Both. They are normally stowed in the hull but before release are moved under the wings.
12. The Pegasus XVIII as fitted in the Hampden and Wellington.

The engine illustrated is the Daimler-Benz DB 600.

Last week's problem picture was the tail of the Gloster F.5/34.